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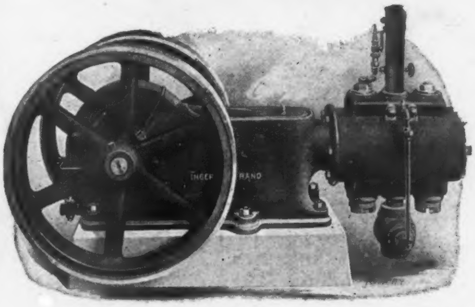
# COMPRESSED AIR MAGAZINE

DEVOTED TO THE USEFUL APPLICATIONS OF COMPRESSED AIR

Vol. XV | JUNE, 1910 | No. 6

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Classified Buyers' Guide, Page 12. Index to Advertisers, Page 8.

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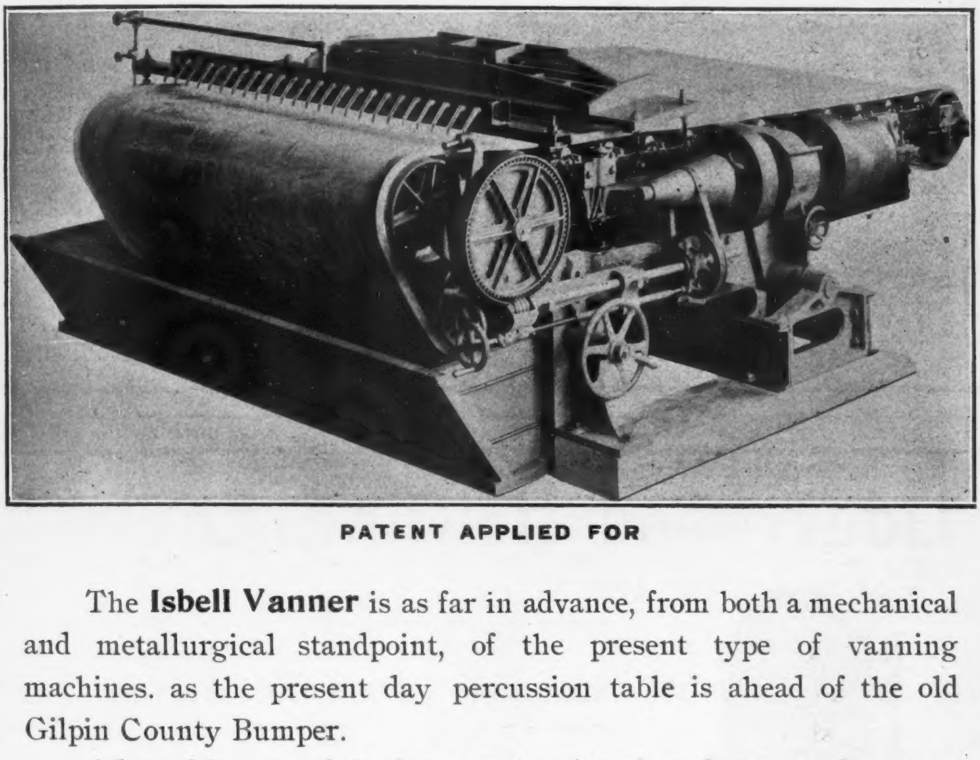

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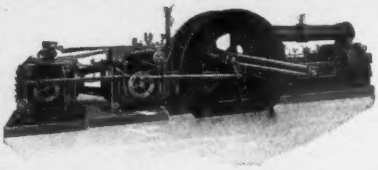
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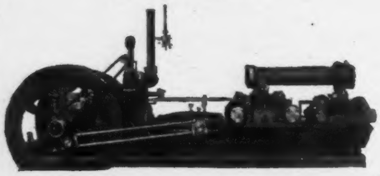
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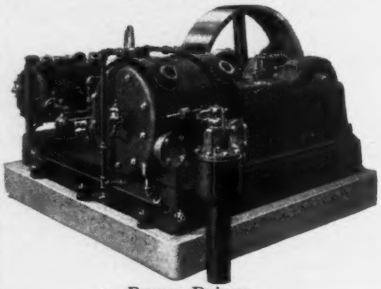
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Nov. 9, 1908.

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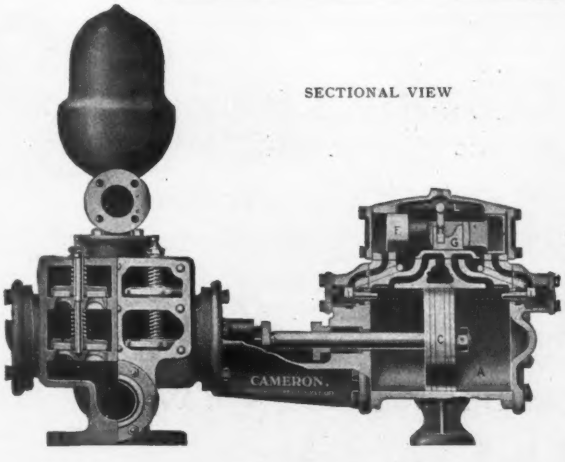


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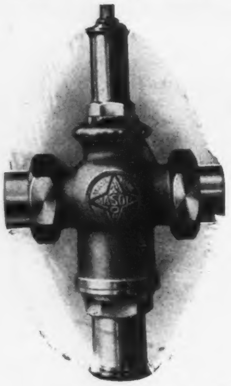

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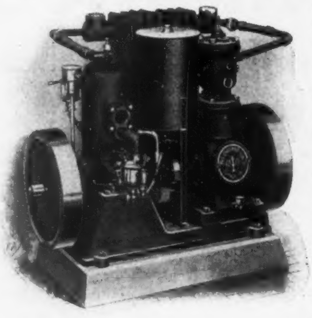

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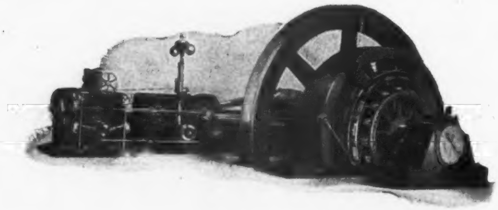

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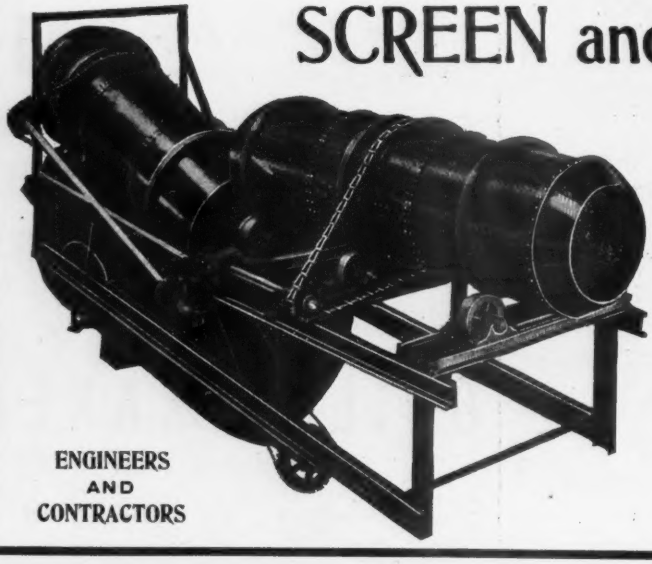

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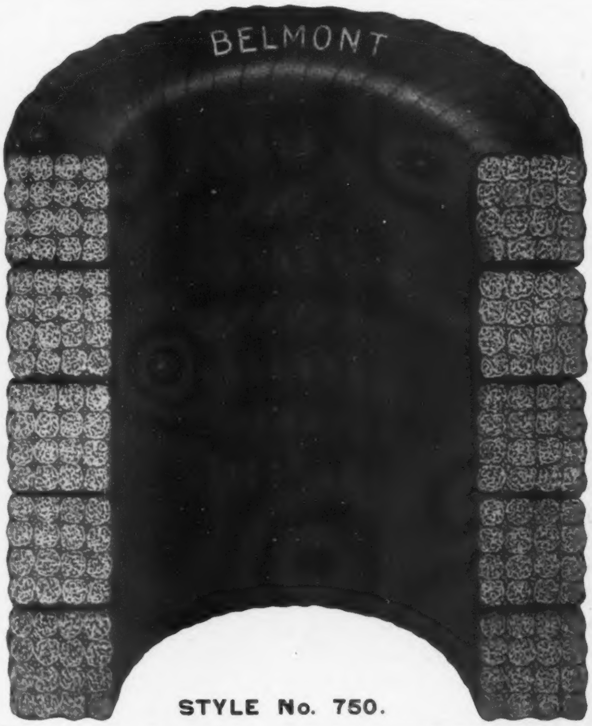


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Made expressly for
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**Will withstand** the extreme dry heat of **Compressed Air** and give excellent service on **Dry Steam, etc.**

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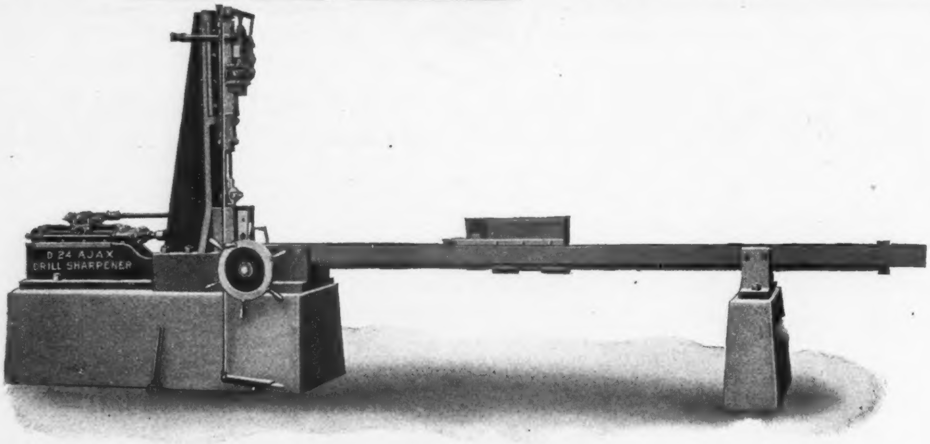


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They use Ingersoll-Rand Drills for hammers, making it possible to secure duplicate parts of these most important features *anywhere*.

All parts are made much heavier than even the most severe stresses upon them require.

The dies and dolly are much larger, insuring long life and low cost of renewal.

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They can be operated either as right or left-handed machines—an exclusive "Ajax" feature.

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They will sharpen drills faster and better than any other known way.

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# COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC.

Vol. XV JUNE, 1910 No. 6

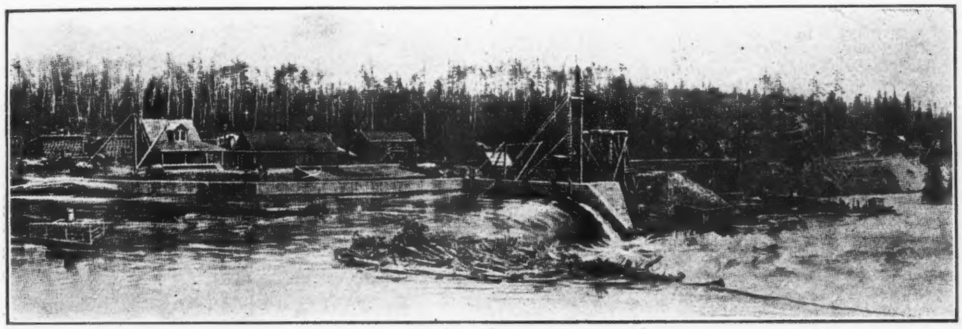


FIG. 1. SURFACE WORKS OF COBALT HYDRAULIC AIR COMPRESSOR.

## THE TAYLOR HYDRAULIC AIR COMPRESSOR AT COBALT, ONTARIO

What is undoubtedly the largest single unit air compressor in the world is being constructed on the Montreal River at Ragged Chutes, about nine miles south of Cobalt, Ontario, Canada. This plant operates on the now well known Taylor system, where the air is compressed by the direct action of falling water. The following account may be accepted as authoritative in every particular, having been prepared by Mr. C. H. Taylor for *Mines and Minerals,* from whose pages it is here reproduced, somewhat abridged and rearranged.

The Cobalt Hydraulic Power Company, Limited, is a commercial organization formed for the purpose of selling compressed air to the various Cobalt mines. At Ragged Chutes there is a drop in the river of 54 feet within less than a quarter of a mile. This entire head is to be utilized, furnishing 5,500 horse power and compressing 40,000 cubic feet of free air per minute to a gage pressure of 120 pounds, which is automatically reduced to and maintained at 100 pounds when delivered to the various mines. The air will be transmitted through 9 miles of 20 inch pipe, from the end of which there are two 12 inch branch pipe lines. About 7 miles from the compressor there is another 12 inch branch, so that the total length of piping, 20, 12, 6 and 3 inch, will be about 21 miles.

In order to prove that this power would be a great saving over the present cost for compressed air, about 6 months were spent in making exhaustive tests at a number of the larger mines, and the reports were accepted in every case by the managers. The tests showed that mines could save from one-half to one-third by buying their compressed air rather than producing it, and at the same time could receive the air at a constant pressure. In addition to the advantages mentioned, it is to be understood that the air, being isothermally compressed, is, of course, as dry as possible, thus eliminating the troubles arisng from freezing; further, there being no oil

used in compression, the compressed air is practically odorless and ventilates the working faces, which is a distinct advantage. The various Cobalt mines will be piped independently of each other and the air will be sold by meter measurement or by the drill unit as a basis. If sold by meter, a rate of 25 cents will be charged for each 1,000 cubic feet of compressed air per minute, the air pressure being 100 pounds per square inch. The company will furnish in this case an automatic reducing valve, meter, and limit valve. When air is sold on the flat rate, the charge will be based on one drill per shift, the charge, however, decreasing with an increasing number of drills. In this case, the power company will supply the reducing and limit valves, no meter being needed.

Great care has been taken in the installation of the pipe lines to prevent leaky joints and strains on the pipe. In the 20-inch and 12-inch diameter pipe lines, balanced expansion joints have been placed at half-mile intervals, and half-way between each two expansion joints the pipes are anchored in massive concrete piers to prevent their creeping.

Fig. 1 furnishes a good idea of the general lay of the compressor plant and dam. In the center is shown the gate section, north retaining wall, and part of the spillway. At the extreme right may be seen the outlet shaft. After passing the gates the water flows through two 16-foot diameter intake heads, one of which is shown in Fig. 3 at *a*. In each of these heads there are 66 14-inch diameter pipes *b* set in a steel disk *c*. Below the pipes, the heads gradually diminish in diameter until they become 8 feet 4¾ inches, and from this point they are 15 feet long. In this telescopic form the heads connect with the intake shafts, which are 8 feet 6 inches in diameter and 345 feet deep, with the orifice of the head at the surface of the water. This arrangement permits the heads to be raised or lowered, to conform to the level of the water in the forebay, or the heads may be raised above the level of the water by air lifts *d*, thus cutting off the supply completely. The two air-shift cylinders *d* act as governors, automatically raising and lowering the heads which are suspended from them by the hangers *e*, thereby regulating the flow of water into the intake pipes *b*, according to the demand. The head pieces were especially designed to meet conditions due to extremely low temperatures. The gate *f* is raised by rack and pinion, and there is the

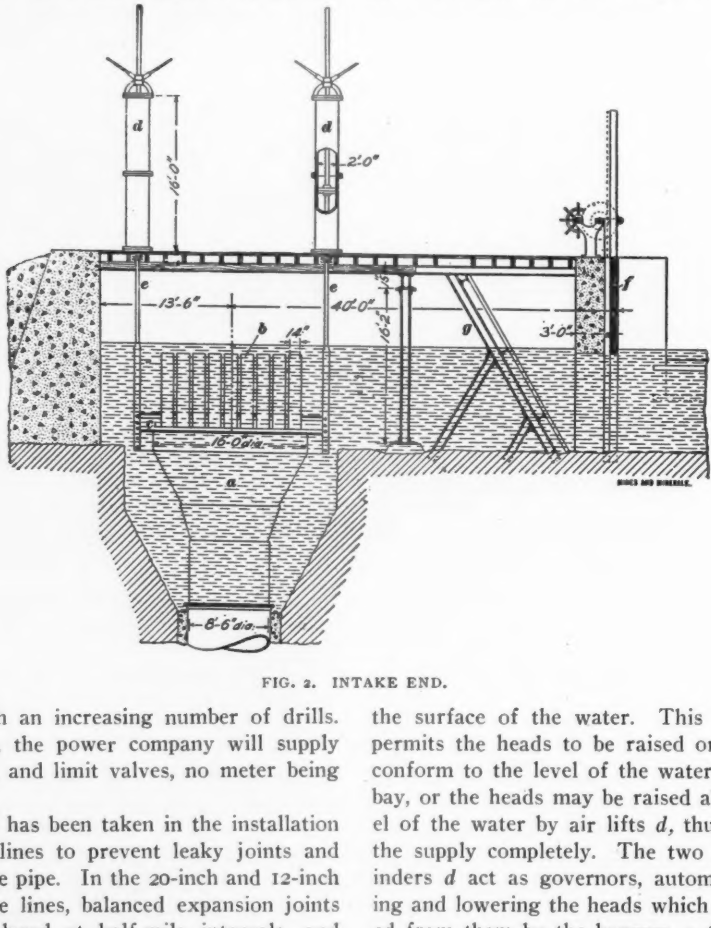



FIG. 2. INTAKE END.

usual rack *g* to prevent floating material from entering the head-pipes.

The water, with the entrained air, flows through the heads with a descending velocity of from 15 to 19 feet per second, gradually diminishing in the velocity of fall, owing to the compression of the volume of air; finally there is a further reduction in velocity owing to the enlarged section of the last 40 feet of fall, shown in Fig. 2. By the time the water reaches and strikes the steel-capped concrete diverting cones *a*, its velocity is so diminished by the baffle from the compresed air that there is little shock.

The cones *a* are for the purpose of spreading the flow of air and water, thereby bringing the air nearer the flow through the tunnel. The air being lighter than the water, it rises to the surface of the water under a pressure of 120 pounds per square inch. The tunnel was made 20 feet wide, 26 feet high, and 1,000 feet long, the latter for the purpose of utilizing the total head of the stream, although this length was not necessary in order to give the air time to leave the water before the latter started up the outlet shaft *b*. As the velocity of the water in the tunnel is about 3 feet per second, practically all the air will leave the water in the first 300 feet. The last 75 feet of the tunnel has the height reduced to 16 feet.

The pressure given to the air is due to the height of the body of the water in the outlet shaft, which in this case is 298 feet deep and 22 feet in diameter. The water flows along the tunnel and up the outlet to the river, the difference in elevation between the mouth of the intake and the discharge tunnels being 47 feet. Near the outlet end of the tunnel its height is increased to 42 feet, and at this place two pipes are carried through the 30 degree riser *c* to the uptake shaft. One pipe *d*, 24 inches in diameter, carries the compressed air to the surface, where it is connected with the 20-inch main air pipe line. The other pipe *e* is 12 inches in diameter and has its end submerged at a safe distance above the roof of the outlet portion of the tunnel, to act as a blow-off in case the air in the tunnel should acquire such pressure as to force the water below the level of the tunnel outlet. If the air were allowed to escape up the outlet it

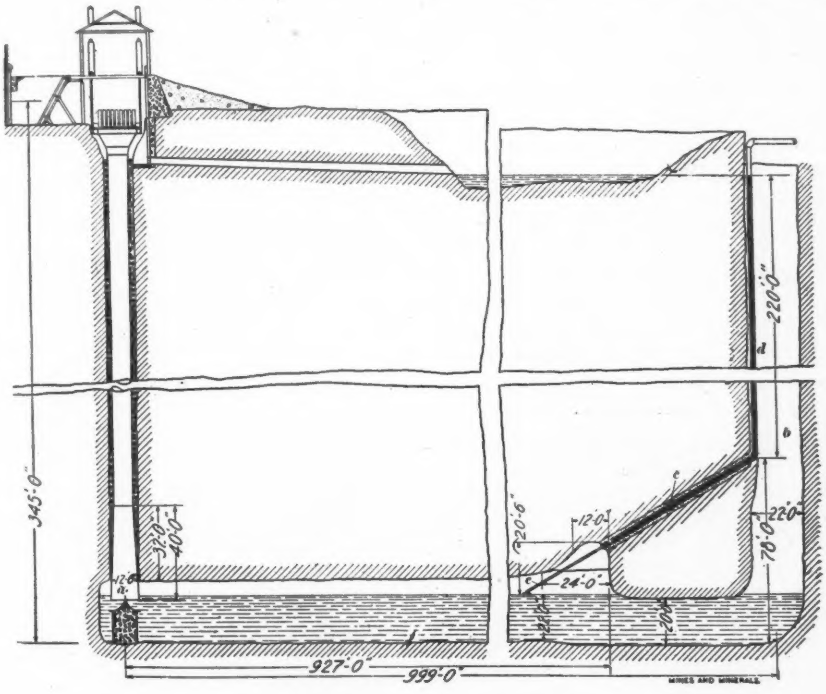



FIG. 3. DIAGRAM OF COMPRESSING PLANT.

would lighten the column of water in that shaft, and the air pressure would not be constant. The blow-off pipe ends at the upper level of the water in the outlet shaft, its end remaining open to the atmosphere. When the volume of air is greater than the demand, the air accumulates in the upper part of the tunnel, forcing the water down and exposing the lower end of the blow-off pipe *e* to the compressed air, thus allowing a portion of the water in this pipe to drop back, thereby decreasing the weight of the remaining water in this pipe to less than the pressure of the air. The equilibrium is now overcome and the water in the pipe is driven upward to the surface, where a most spectacular sight is witnessed, as the body of water is shot out by the air sometimes to a height of 500 feet. The blow-off continues until the pressure of the air in the tunnel is sufficiently reduced to again submerge the end of the pipe. Water now rises until an equilibrium is established between the air and the water pressure in the tunnel. The air pipe and the blow-off pipe are packed in concrete the entire length of the 30 degree riser, in order to seal them in and prevent any escape of air up the outlet shaft. Thus these arrangements permit the delivery of a large body of air at a constant pressure at all times.

## FALSE ECONOMY IN AIR CONSUMPTION*

There has been quite an amount of talk about machine air costs, and it seems that some people are as mad about this so-called economy as they are about running three or more machines per man. They do not bother about the half-crown they lose if they can gain threepence in the airs costs. To me it appears that the machine that drills a few feet more per shift is the one to be after, even if air costs are 20 per cent. higher. For instance air costs per machine shift are, say, 6s.; then say 30 per cent. is leakage, etc., leaving 70 per cent. against the machine itself. This equals 4s. 3d. The machine drills 24 ft. per shift and breaks two-thirds of a fathom of ground. Now suppose we change the machine and use one that takes 50 per cent. more air, making the cost 6s. 4d. against the machine itself. Leakage will be the same, and how much more work must the new machine do to pay for its extra cost? To get at this we must know the total cost of breaking ground per fathom. This we will take at say 70s.; even with the three machines per man, 70s. equals 46s. 8d. per shift, equals 1s. 11.3d. per foot, so to pay for the 50 per cent. increase of cost of air for the machine we only need another foot of drilling from the machine, despite all the worry about getting a machine to save air. I think looking at the air costs alone is wrong if we really wish to lower the machine costs. The same reasoning applies to whatever machines a mine may be using. Do not worry particularly about the cost of air per machine shift, but to the cost per fathom, and strive to get the best from the air.

Do not let your machines get into the rattletrap stage, but spend money on keeping them in order. If one machine fitter has a hard job to keep the machines in fair running order, have two and keep the machines in good order, the total cost being the point to watch. Let any individual item rise if by so doing the total is lowered. We have at the present time some very good drilling machines on the Rand, but we do not get the work out of them that they are capable of doing. It is well known that there is a very great difference betwen the lowest and highest cost per fathom on any mine. I figure it that some men can do fairly well on three machines and others cannot. Why then give the poor man three machines? Give him the same price per fathom and let him try fewer machines. I have often seen men make as much money stoping with one machine as with two, the same price per fathom being paid.

The moral is: get a machine that can drill, and a man at the back of it to see that it does drill. Then machine costs will come down even if air costs are higher. Some use the argument that if a machine uses less air we can use more machines with the same compressor plant, but I say, get the same footage from a smaller number of machines even if each takes more air. Money is saved, because there are less machines to buy and less machine men required, leaving us the chance of keeping out some of the men who have not yet learned their business.

*Tom Johnson, in Journal of Chemical, Metallurgical and Mining Society of South Africa.

## THE HISTORY OF THE ROCK DRILL AND OF THE INGERSOLL-RAND COMPANY

BY W. L. SAUNDERS.

The percussion rock drill, as distinguished from all other types, is an American invention, the first practical patents having been taken out by J. J. Couch of Philadelphia in 1849. Couch was assisted in building this drill by Jos. W. Fowle, later of Boston, their experiments being carried on during the year 1848. The Couch drill was a crank-and-fly-wheel machine, and its application to practical work was therefore limited to surface hole drilling.

In 1848 Couch and Fowle separated, Fowle filing a caveat in 1849. This caveat describes the type of successful power rock drill used to-day. The chief point was that Fowle first showed a drill where the cutting tool is attached directly to the piston or to the crosshead connected with the piston. In other words, the bit leading into the hole was an extension of the piston rod. This important invention was described by Mr. Fowle, in his testimony before the Massachusetts Legislative Committee in the contest with Burleigh in 1874, as follows:

"My first idea of ever driving a rock drill by direct action came about in this way: I was sitting in my office one day after my business had failed and happening to take up an old steam cylinder, I unconsciously put it in my mouth and blew the rod in and out, using it to drive in some tacks with which a few circulars were fastened to the walls."

The nearest approach to rock drill inventions abroad was in the German work of Schumann, in 1854. Fowle being without means, but a genius in the true sense, his inventions remained in obscurity until Charles Burleigh purchased his patents and produced the Burleigh drill, about the year 1866. This drill was used in the Hoosac Tunnel in 1867. Following these inventors came Haupt, De Volson Wood, and Simon Ingersoll, and after these were Sergeant, Waring and Githens, Githens being the inventor of the Rand Drill.

The Ingersoll drill was invented in 1871.

Simon Ingersoll, an ingenious, modest and honest mechanic, came to New York from Connecticut. Having a very fertile mind, he had conceived several inventions, models for which he made with his own hands. While riding in a horse car in New York, and being of a very confiding and loquacious disposition, he described to a fellow-passenger the merits of one of these. One of the passengers in the car who overheard the conversation was John D. Miner, a contractor, who had a gang of men at work upon rock excavation in what was then the upper part of New York. Miner broke into the conversation by asking Ingersoll why he didn't invent a rock drill, something practical, something useful, instead of spending his time and his genius upon "such traps." Ingersoll asked him what he meant by a rock drill and what he wanted to do. Miner's reply was that he had a gang of men at work on the rocks in New York striking steel with a hammer in order to make a hole for blasting; that they could only do about 10 feet a day; and that he couldn't see why the work could not be done by machinery. Ingersoll said he could make a machine to drill the rock and would go at it at once if he had the money. Miner then and there gave him $50.00, together with his card, telling Ingersoll that, though he had never met him before, he had an honest face and he would trust him to spend that $50.00 in building a rock drill. "When you want any more," said Miner, "come to me and I'll give you another fifty."

Ingersoll made his drawings and models and built his first rock drill at a little shop on the corner of Second Avenue and 22nd Street, this shop being owned by Mr. J. E. de Navarro, who operated it under the management and title of Sergeant and Cullingworth, Mr. Henry C. Sergeant came into the works one day and saw the patterns for the drill. The front head was attached to, and was a part of, the cylinder. Mr. Sergeant's fertility in invention was here shown when he very promptly told the men at work that the head and the cylinder should be in two pieces, and of his own accord he took a hand saw and was in the act of separating them in the pattern when the inventor Ingersoll arrived. "What are you doing?" said Ingersoll. "I'm making this thing practical," was Sergeant's response as he finished sawing off the head before Ingersoll could stop him. The result was the first row between Ingersoll and Sergeant, which afterwards resulted in Sergeant's inducing Mr. Navarro to purchase all Ingersoll's rights and patents; and the drill was made with the detached front head, as it is made today.

The success of the machine was soon apparent, and after Mr. Navarro had purchased the

patents he organized a company called the Ingersoll Rock Drill Company, putting $10,000 in the enterprise. Mr. Sergeant was now in full control and through him many very important improvements were added. Litigation arose at once with Mr. Burleigh of Massachusetts, who owned the Fowle and other rights, but through Mr. Navarro's plentiful command of funds and his liberal nature, the suits were settled and all the fundamental patents were placed with the Ingersoll Company.

The $10,000 which started the drill business was shortly afterwards paid back to Mr. Navarro. In later years he sold his rights for $525,000. Mr. Sergeant having sold out because of friction with the management, went West, engaged in mining, lost his money and returned to New York about the year 1885 starting the Sergeant Drill Company.

Addison C. and Jasper R. Rand had early become interested in rock drills through their connection with the Laflin and Rand Powder Co. Addison C. Rand formed the Rand and Waring Drill and Compressor Company, later controlled entirely by Mr. Rand and merged into the Rand Drill Co., established in 1871 and incorporated in 1879.

J. C. Githens, manufacturing superintendent of the Rand Drill Company, was the inventor of the "Little Giant" rock drill and also of the double screw column with column arm, which made practical the application of the rock drill for mining and tunneling.

The Sergeant & Cullingworth Company, a manufacturing concern engaged in building the Ingersoll drill, the Sergeant Drill Company and the Ingersoll Rock Drill Company were merged into The Ingersoll-Sergeant Drill Company, and later on the Rand Drill Company was added to this amalgamation, forming the Ingersoll-Rand Company. The Rand drill had from the beginning been the most formidable competitor of the Ingersoll. The conjunction of the two concerns was a combination of valuable patents in rock drills, air compressors and general mining, tunneling and quarrying machinery. Each shop received the benefit of the experience of the other, and the best points in Ingersoll and Rand types were taken to improve the product. The present company, which has a capital of $10,000,000, sells its product throughout the world; it is the recognized standard in its line, the volume of business is larger than that of any other concern producing this class of product, and it has always endeavored to maintain its standard up to and in advance of the times.

## A NEW RECORDING CLINICAL THERMOMETER

Consul-General John L. Griffiths sends an account of a new clinical thermometer which is exciting much interest in British medical circles. The thermometer consists of a very fine flattened coil of platinum wire, 1-250th of an inch in diameter, wound on a thin strip of celluloid film. This coil is then covered, for the purposes of insulation, by a second thin film of celluloid. The ends of the platinum wire are connected with ordinary copper flexible electric light leads. An extremely sensitive galvanometer, which will instantly record any increase or decrease in the amount of electric current passing, is let into the circuit. The leads then pass to an electric recorder, on which the extent of the variations in the current passing are noted by an upward or downward swing of an ink-tipped pointer traveling on a continuously revolving paper-covered drum or cylinder. The principle underlying the thermometer is that any change in temperature of the coil of platinum wires will vary the amount of current which can pass through it, this change being determined by the galvanometer and recorded on the revolving drum. The thermometer, which is in an insulated celluloid case, is to be placed in the arm pit and kept in position by a bandage which will pass over the opposite shoulder. The arm will also be bandaged to the side in order to protect the thermometer from all atmospheric influences. It is expected that this new instrument will be used chiefly in hospitals in the treatment of such diseases as typhoid fever and pneumonia.

## AN AUTOMATIC SPRINKLER "SET"

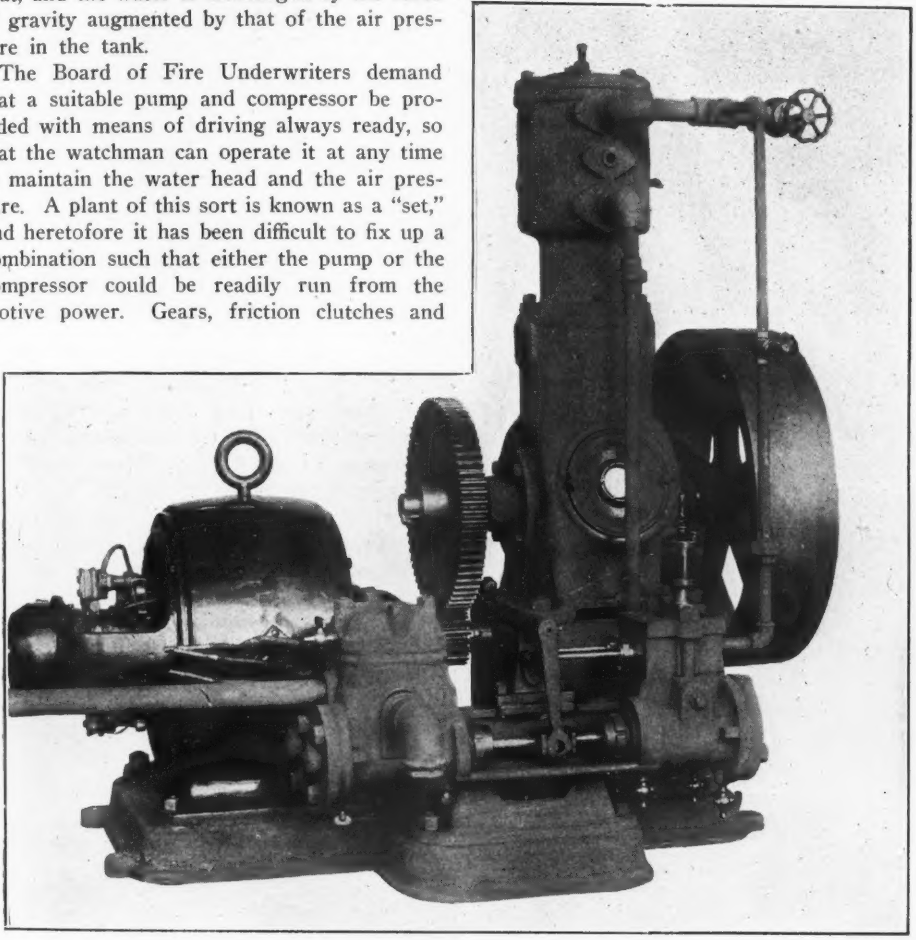
The half tone shows an interesting electric, pneumatic, hydraulic combination which is proving highly satisfactory for the special purpose it is designed for. It is the responsible and actuating member of an automatic sprinkler system as installed in many buildings in San Francisco and elsewhere in compliance with the requirements of the Board of Fire Underwriters. In the system of which this apparatus may be assumed to be a part, there is a tank upon the roof holding, say 6,000 gallons, more or less, which normally is filled two-thirds with water and one-third with

air at a pressure of, say, 75 pounds. Then from this tank pipes lead along the ceilings of the various rooms with sprinkler heads located where they may be expected to be most effective in case a fire starts. These heads are plugged with a material which melts at a low heat, and the water is discharged by the force of gravity augmented by that of the air pressure in the tank.

The Board of Fire Underwriters demand that a suitable pump and compressor be provided with means of driving always ready, so that the watchman can operate it at any time to maintain the water head and the air pressure. A plant of this sort is known as a "set," and heretofore it has been difficult to fix up a combination such that either the pump or the compressor could be readily run from the motive power. Gears, friction clutches and change mechanisms which have been tried have been expensive and unsatisfactory. The "set" here shown seems to simplify the proposition. The motor drives the compressor and the air compressed is partly used to drive the pump and partly goes to maintain the air supply in the tank. All the air compressed and also air from the tank may be used to drive the pump if circumstances require it. The exhaust from the pump returns to the compressor, and as its temperature is lowered by the work it does, this is an economical feature.

With the motor and compressor running at constant speed the throttle in the compressed air pipe heading to the pump controls the proportions of water and of air delivered to the tank. If the pump is run slowly there will be a surplus of air going to the tank, or if the pump is run at more than normal speed it may take not only all the air delivered by the compressor, but also some from the tank. In that case the tank could spare some air without loss of pressure as the inflow of water from the pump would be reducing the air space.

The "set" as here shown weighs 850 pounds with alternating current motor, and 1,050 pounds with direct current. The arrangement is the invention of Mr. E. A. Rix, president of the Rix Compressed Air and Drill Company, San Francisco, Cal.



BIG AUTOMATIC SPRINKLER SET


FIG. 1.

## NEW FARWELL PNEUMATIC ROLL-OVER MOLDING MACHINE

From the series of half-tones here presented we may obtain a clear understanding of the construction and operation of the above machine. As will be seen, it jolts the mold, turns it over and draws the pattern, the jolting being equivalent in effect to, and thus dispensing with, the operation of ramming, doing the work more satisfactorily and much quicker. The combination of these features in a portable machine is said to be new.

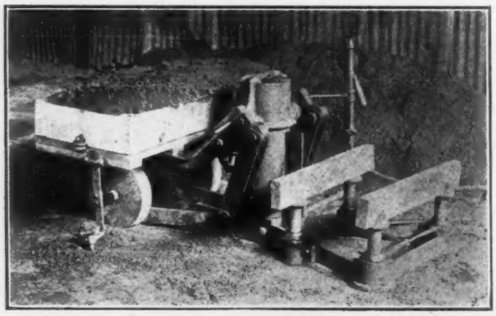


FIG. 2.

Fig. 1 shows the machine entirely bare. The base or frame has two heavy, solid cast iron wheels J which run upon a track embedded in the floor, thus affording an ample foundation at small expense, and without requiring a permanent locating of the machine in any particular spot. The wheels are made so heavy to serve, as will appear, as an anvil for the jolting.

The machine is of course actuated by compressed air. In the center of the base is fixed a vertical trunk piston or plunger upon which works an inverted cylinder E, on the sides of which near the middle are projecting trunnions which serve as pivots for the angle iron frame M, which carries the molding flask. At the beginning of operations the heavy iron blocks *A* fastened to the frame M rest upon the wheels J on each side. Inside the frame as it rests on the wheels in Fig. 1 is seen the Adam's pneumatic rapper K which frees the pattern in the sand before and during the drawing.

In Fig. 2 we see better how the castings

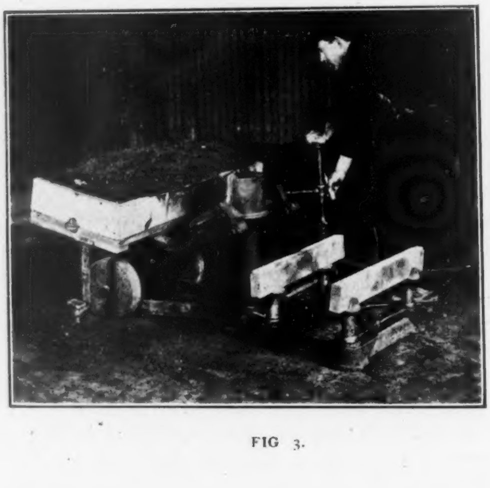


FIG 3.

FIG 4

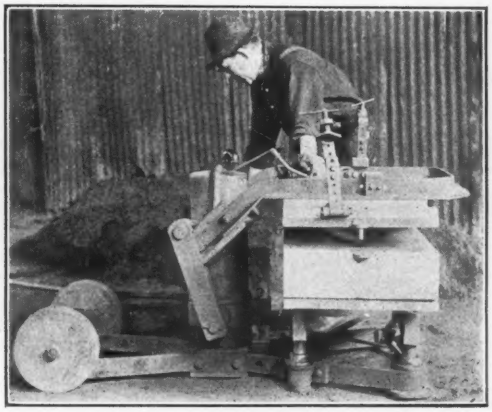


FIG 6

which carry the angle iron arms are pivoted on the cylinder. These castings have heavy lugs which form the short arms of levers for lifting the frame M and the flask placed upon it, the connections L being attached to these lugs, the lower ends of the connections being pivoted to the movable yoke F. When air is admitted to cylinder E frame M rises vertically with it until yoke F strikes pin G inserted in one of the holes of the upright according to the requirements of the particular job. When yoke F strikes pin G, the cylinder continuing to rise, then the frame M begins to tilt for rolling over the flask.

In Fig. 2 the match board has been attached to frameM—this match board with the pattern is seen clearly in Fig. 8—a flask has been placed upon it and filled with sand ready for jolting.

Fig. 3 shows the operation of jolting, which is accomplished by admitting air to the cylinder and exhausting, both of which operations are controlled by the same valve. The experience of the operator determines the number and force of the jolts required.

After jolting and striking off, the bottom board is placed in position and clamped, Fig. 4 showing the flask being turned over. This is done by admitting air until cylinder E rises to its highest position, the operator perhaps assisting the flask as it passes over the center, and then on slowly releasing the air the flask descends until in Fig. 5 it rests upon the cross-pieces B. These cross-pieces rest upon the four plungers C which are provided with springs which automatically equalize or adjust themselves to the irregularities of the bottom board on all four points, and as soon as the

FIG. 5.

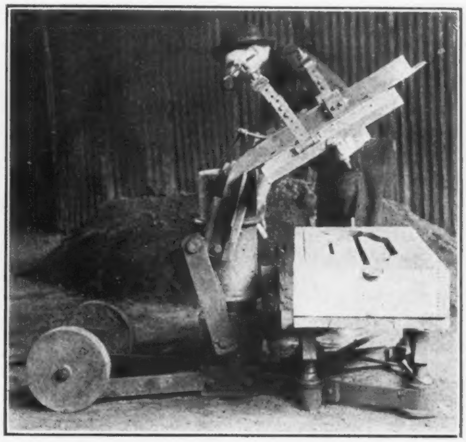


FIG. 7.

FIG. 8.

mold rests fully upon the cross-pieces the plungers are locked in position by a single movement of the lever D, which is connected by links to all four plungers. This lever may be kicked into locking position by the foot. The molder then releases the flask clamps and is ready to draw the pattern.

This operation is shown in Fig. 6. The molder with his right hand operates the air valve which admits air to the main cylinder, and with his left hand he opens a pet cock, admitting air to the pneumatic rapper. The pattern is drawn vertically to any desired height, which is determined by the placing of the pin G in one of the holes of the upright bar, before starting to roll over, and this combined with the pneumatic rapper and the steady air control gives a good, clean lift.

Fig. 7 shows the position when beginning the rolling over and Fig. 8 after the match board has passed the dead center and is descending to its original position, ready to receive another flask and start another mold.

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The tunnel on the Jungfrau mountain line is being driven at the rate of 10 to 12 feet per day. The line is expected to be opened to an elevation of 11,090 feet in the spring of 1912, and will eventually be carried to 13,670 feet, or only 242 feet below the summit.

## DANGEROUS OXY-ACETYLENE APPARATUS

It will be remembered that in the issue of COMPRESSED AIR MAGAZINE immediately preceding this we printed an account of a fatal explosion of an oxy-acetylene apparatus in New York City. The following letter sent out by Mr. Augustine Davis, President of the Davis-Bournanville Company, it will be seen, carries suggestions bearing upon that catastrophe, although not specifically referring to it.

If the union of oxygen and acetylene did not produce an unusually powerful agent, the oxy-acetylene process would not have its present value. Acetylene is by far the richest of all gases in carbon, and combined with oxygen, produces much the hottest flame that has yet been created. It is generated from calcium carbide, which is nothing more than coke and lime combined at a very high temperature, but the finished product is as inert, and as little dangerous, as crushed stone, unless put in contact with water, and it can be subjected to any kind of rough usage without the least danger. Acetylene itself, can not be ignited without a mixture of air, or oxygen, unless it is compressed to more than thirty pounds pressure.

Chemically, oxygen is made from chlorate of potash, and similar materials, which are not dangerous unless placed in contact with carbonaceous matter, so that neither carbide, acetylene, nor the chemicals, are at all dangerous if they are properly handled; improperly treated, they can be made exceedingly dangerous, just as can ordinary coal, or water gas, or any of the hydro-carbons, such as gasoline, or oil.

The present acetylene generator is the evolution of various types that have been tested by years of use, and most of the earliest processes have been discarded by responsible manufacturers. Hundreds of thousands of acetylene generators are in use in the United States, and have become so important in the lighting industry, that they are the subject of yearly inspection by a body of engineers, in a laboratory which has been established by the National Board of Fire Underwriters. These engineers have become experts in the generation of acetylene, and have prescribed rules for the construction of such generators, which are the outcome of years of constant examination of apparatus of this character.

Generators built in accordance with these rules, can be accepted by the public as desirable types.

These engineers, and the experience of a number of reputable manufacturers, have demonstrated beyond question, that what is known as the carbide-to-water types, are most desirable for the generation of acetylene. Carbide has what is termed "endothermic heat," which is similar to the heat of lime when slaking, only the heat is much greater. One pound of carbide will boil six pounds of water; consequently the engineers for the insurance underwriters have a rule, requiring one gallon of water for each pound of carbide, which, it will be apparent, is sufficient to insure cool generation.

The types generally discarded are known as the water-to-carbide generators. The methods employed in this type were to sprinkle water on the carbide, or to flood compartments, or were of the recession type, where the water rose to the carbide and was forced back by the gas generated when the water came into contact with the carbide. All of these types are objectionable, because there is not a sufficient supply of water present for proper chemical reaction, and it is entirely absent so far as cooling is concerned. The result is that more or less gas is polymerized, or turned into tar vapors, by the excessive heat evolved locally, making a poor gas; and with rapid generation, there is danger of the heat becoming so great as to melt the portions of the generator in contact with the carbide, and to create danger of explosion should the generator be opened when the carbide is in this heated condition. Generally, the carbide is in the interior of the generator, surrounded by water, so that the heat is not perceptible from the outside of the generator, but it exists nevertheless.

Attracted by the supposed profits in the sale of oxy-acetylene apparatus, a new crop of generator makers, who are either unfamiliar with the established methods of generation, or unscrupulous, are springing into existence, and are placing these undesirable types on the market. They are doing exactly what was done with lighting generators, in the earlier part of their history, until there became a great class of what was known as "tin can" machines, the poor results from which it took years of strenuous efforts by the better class of makers to overcome. These types of generators are even more objectionable for oxy-acetylene welding than they were for lighting purposes, because the gas consumption is much more rapid, multiplying the bad effects from this improper generation. Should such generators be subjected to the inspection of the insurance engineers, they would unquestionably be promptly rejected.

Bad as is this method of gas generation, a still worse condition exists. It is known to those who are at all familiar with acetylene, that when it is compressed to from 30 to 45 pounds, or more, there is a kind of disintegration of the molecules, causing the gas to be explosive in the presence of a spark. In the early history of the art, some terrific explosions occurred from compressing acetylene in this form, and for a time its use under compression was entirely abandoned. Through a French discovery it was learned that if cylinders were completely filled with a porous material, and this material was then saturated with acetone, the acetone would dissolve the gas to twenty-five times its own volume for each atmosphere of pressure, and that when the pressure was relieved the acetone would give off the acetylene, and that this method not only gave the cylinders a marvelous capacity, but made it entirely safe to use acetylene in this form. The "Presto-o-lite" cylinders, which can be found on almost any automobile, are examples of what has been done in this line, and many railroad cars are lighted by this system. It is also employed quite extensively in oxy-acetylene welding for portable uses.

In the face of past disastrous experience, there are persons who are manufacturing acetylene by compressing it direct from carbide, without purification, and during the past year there have been several fatal accidents from this cause. In one case nine people were killed, and the directors of the International Acetylene Association held a special meeting, and passed resolutions condemning this process, which it is nothing less than criminal to employ.

A method is being used to make apparatus portable, which is nothing more or less than to place an acetylene generator on an ordinary truck, and wheel it about. A generator in this position is not only likely to be accidentally tipped from the truck, but it may be placed in

close proximity to red-hot furnaces, or struck by swinging cranes, or injured in many other ways, and it does seem as though any careful, thoughtful person could immediately realize the danger of such an arrangement. If the generator should be tipped over, it would immediately bring the whole body of water and carbide into contact, which would certainly burst the generator, and the volume of gas released might come into contact with fire, and an explosion follow. Obvious as is this danger, there are men in important mechanical positions to whom it did not occur until their attention was called to the possibilities. Certainly, no intelligent insurance representative would approve of such apparatus.

So far from acetylene being considered dangerous, when properly manipulated, the highest insurance authorities have concluded that it is much safer than movable units, such as lamps; and there is no reason why it should not be equally safe for oxy-acetylene purposes.

The conditions with regard to the generation of oxygen, are not much better. The desire of many persons, who can use the oxy-acetylene welding process to advantage, to obtain apparatus at very low cost, has proved to be a great incentive to constructing the apparatus cheaply.

Oxygen has been produced in this country for many years from chlorate of potash, and similar chemicals, but in such cases it has been the practice of the most prominent manufacturers to generate this gas under only sufficient pressure to wash it thoroughly, and force it into a gasometer, from which it is compressed by a compressor into tanks for portable use. It does not require much thought to realize that it would be much cheaper to generate the oxygen in the retorts, under sufficient pressure to force it into the tanks ready for use. This would cut out large washers, the gasometer, and the most expensive part of the plant, the compressor; such a plant could be built at small cost, and at considerable profit. That this is being done, and advertised quite extensively, requires only the examination of the advertising columns of a number of trade papers to show.

The most approved types of plants generating oxygen from chemicals, have the compressors built with two stages of compression, with an intercooling coil between the cylinders, and with the cylinders totally submerged in water, so that even though there are impurities in the gas, there is not sufficient heat generated to ignite the mixture. It is also required that the parts of these compressors subjected to oxygen must be of non-corrosive metal, which adds still further to their cost. It will be evident that plants not having these necessary requisites can be, and are, sold for much less than properly constructed apparatus.

Defective and dangerous types of oxy-acetylene apparatus have not, as a rule, given satisfactory results, and they thus tend to discredit the process. Such apparatus has injured the art not only in this country, but in Europe as well. Solicitations have been received by the company which the writer represents, to sell its apparatus in Austria, by a very prominent firm, whose letter states that that country has numerous cheap and ineffective plants, which have brought the process into disrepute.

## PAINTING WITH A PISTOL

The cut, from *Popular Mechanics*, shows a fountain air brush for either the fine work of the artist or for painting large surfaces. The paint is contained in the holder above the barrel, and compressed air conveyed by a tube presses up through the handle into the barrel where it picks up the paint and sprays it onto the surface to be painted. The tool is made in several sizes, ranging from the fine needle point apparatus to those used for painting vehicle bodies and the like.

## DRYING AIR BLAST WITH CALCIUM CHLORIDE

Two French Metallurgists, M. M., F. Daubiné and E. Roy, have succeeded in developing a cheap and efficient process for drying blast furnace air by means of calcium chloride. They were attracted to the problem by the success of the Gayley refrigerating process. In a blast furnace with an output of 130 tons per day, using moist air, it was calculated that by drying the air the output could be increased to 150 tons, and at the same time the cost of production could be reduced by from 40 to 60 cents per ton. For a plant of this size the expense of installing a refrigerating plant would be at least $60,000, and the operation, maintenance and depreciation cost would be very close to 40 cents per ton.

Calcium chloride, the cheapest, most active and most easily handled hygroscopic material, is capable of retaining at least as much water as is extracted by the refrigerating process, and regeneration when saturated requires only the application of heat. The hygroscopic power of calcium chloride is greater at low temperatures, so that it is necessary to effect the drying before the air goes to the blowing engines. Further, as the material becomes heated in the process of absorbing moisture, the grating upon which it is carried must be cooled by the circulation of cold water. The rate of absorption falls as drying progresses, hence the speed of the air passing through the mass must gradually decrease, necessitating a gradual increase in the sectional area of the dehydrating mass. The hydrated mass formed on the surface of fragments of calcium chloride is fluid and has a tendency to run, and the air must be passed downward so that what becomes fluid enough to flow will be caught and held by the less hydrated portions below. The calcium chloride must be protected against contamination, so that if furnace gas is to be used to regenerate the spent material, it cannot be allowed to operate directly on the surface of the chloride on account of the danger of dust being deposited in such quantities as to destroy the hygroscopic power of the substance, and also there is a considerable risk of converting a portion of the chloride into carbonate by the action of carbon dioxide.

The new process here spoken of takes account of all these things. Each apparatus is composed of ten similar and superimposed units, measuring about 10 feet square and 16 inches in height. Each unit has three elements: (1) a grating of water-cooled, externally ribbed tubes, which carries the calcium chloride; (2) a series of tubes, triangular in section, imbedded in the chloride and resting on the grating on one of their edges, through which furnace gases are passed; and (3) two flat sheet-iron chambers, one located at the moist-air intake, the other at the dry-air outlet.

The air to be dried is impelled by a fan into a conduit, whence it is distributed among the intake chambers, and from these chambers it passes into the various units of the apparatus. The air then passes downward through the mass of the chloride, which offers to the air a gradually increasing section, as the free air space between the triangular tubes for the heating gases increases progressively downward, from 58 square feet at the top to 97 square feet at the bottom. The dried air passes into another collecting chamber, whence it is led to the intake of the blowing engine.

In the regenerative process the hot gases are led from the flue into a distributing chamber, whence they are distributed among the different sets of triangular tubes. After passing through the tubes they enter another chamber which communicates either with a chimney or with an exhaust fan. During the passage of the heating gases through the triangular tubes a second fan draws through the chloride a regenerating current of air in a direction opposed to that of the air going to the blowing engines. By regulating the speed of this fan, the temperature of the mass of chloride can be adjusted to effect progressive heating, and it can be prevented from rising above 235 degrees C., the maximum limit.

The type of apparatus described is especially suited to works where no surplus motive power is available and where it is necessary to utilize the heat of the furnace gases in the most efficient and economical manner. In plants which have a large surplus of furnace gases, as is the case in many ironworks producing pig iron alone, it may be more economical to waste the furnace gases used in the drying process for the sake of obtaining convenience of construction and facility of operation of the drying apparatus. For such

plants MM. Daubiné and Roy propose a second and simpler form of apparatus. The triangular heating tubes within the mass of the chloride are omitted and the units of the drying apparatus consist of only the water-cooled grating and the hygroscopic material. The drying of the air is effected in the manner already described, but the regeneration of the chloride is carried out by a different procedure. The drying air from the secondary fan is passed through an apparatus resembling a Green economizer. The air flows through a series of externally ribbed tubes surrounded by hot furnace gases or by a similar heating medium. Heated thus it is drawn upward through the mass of spent chloride. At the temperature at which the air leaves the economizer (235 degrees C.) it is capable of absorbing very large quantities of water vapor and acts on the chloride both as a heating and as a drying agent. One economizer is provided for the four drying units of each blast furnace and operates continuously, the hot air being drawn into each unit in turn, as occasion requires.

The researches of MM. Daubiné and Roy have been carried out on an experimental apparatus with an output of 3,500 cubic feet of air per hour. Under average conditions it has been found that the calcium chloride easily dessicates ten times its own weight of air. Allowing a margin of 100 per cent. on the quantity of chloride required, the first purchase will not exceed 25 long tons, at a cost of $500. The total cost of the equipment for each furnace, including the 30 and 20 horse power fans will not exceed $10,000. The material being non-volatile, the waste of calcium chloride must be small. The apparatus would require the attention of only one man per shift, and the power and labor costs would be small, not more than $11 per day. Including an allowance of 4 per cent. for depreciation, the total estimated cost for a furnace with a daily output of 150 tons is $24.40 per day, or 16 cents per ton. The refrigerating process, with the machinery required, costs 39 cents per ton.

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Columbus, Ohio, now has a natural gas supply from West Virginia. The line is 85 miles to the Ohio connections, has three Ohio River crossings and is capable of 20,000,000 cubic feet per day. The same main will supply Cincinnati, Hamilton, Springfield and other cities.

## TWO COMPRESSED AIR MINE LOCOMOTIVES

The half tones on the opposite page show us two interesting compressed air locomotives recently built for mine service by the Baldwin Locomotive Works. Both these engines are of the four coupled type, but they differ from each other more than the half tones suggest, both in size and in many constructive details.

The locomotive for the Lehigh Valley Coal Company is built within a width limit of 5′ 6″ and a height limit of 5′ 7″, the length over the bumpers being 14 feet. The frames are of forged iron, and they have a slab section ahead of the leading driving pedestals. This construction provides a ready means for supporting the cylinders, which are placed between the frames and are securely bolted to them. The cylinders are set on an incline of 1 in 10, so that the main rods will clear the leading axle. The driving axle of course has two cranks inside and is a steel forging made in a single piece. There are two similar air tanks with a combined capacity of 95 cubic feet. Air is stored in these tanks at an initial pressure of 800 pounds, and a reducer keeps an auxiliary reservoir constantly charged to a working pressure of 140 pounds. Safety valves are provided for both the main and the auxiliary resrvoirs at their respective pressures. The equipment includes air brakes for all the wheels, also four sand boxes with spouts to all the wheels. The principal dimensions are as follows:

Gauge, 4′ 0″.
Cylinders, 8″ x 12″.
Driving-wheels, diameter, 28″.
Wheel-base, 4′ 0″.
Tractive force, 3,260 pounds.
Weight, 18,000 pounds.

The locomotive for the Gilson Asphaltum Company, Mack, Colorado, may be said to be about one-half the size or capacity of the preceding. It is lighter and more compact. In the mine where this locomotive is used the air is charged with gilsonite or asphalt dust, rendering it dangerously explosive so that compressed air haulage was adopted as a safety precaution independently of other considerations. The narrowness of the gage permitted only a single air storage tank which has a capacity of 39 cubic feet. The charging pressure is 800 pounds and the working pressure of the auxiliary tank 140 pounds. The frames are of plate steel, supported on coiled springs.


FIG. 1. GAGE 4′ 0″.

The air tank rests directly on the frames, the points of support being over the springs. The cylinders are placed outside the frames in a horizontal position. The function of the heat radiating rings cast around the cylinders is in this case reversed, as the cylinders cool in working and the rings absorb heat from the atmosphere and help maintain the temperature at a workable point within.

This engine is provided with a sand box on each side, and sand can be blown under either front or back wheels. Air brake equipment also is provided with shoes on all the wheels. The auxiliary air tank is placed on the left side and is fitted with a safety valve, as is also the main tank. The nozzle and valve for recharging are seen on the side. The principal dimensions of this engine are as follows:

Gauge, 2′ 6″.
Cylinders, 5½″ x 10″.
Driving-wheels, diameter, 20″.
Wheel base, 3′ 6″.
Weight, 8,650 pounds.
Tractive force, 1,800 pounds.

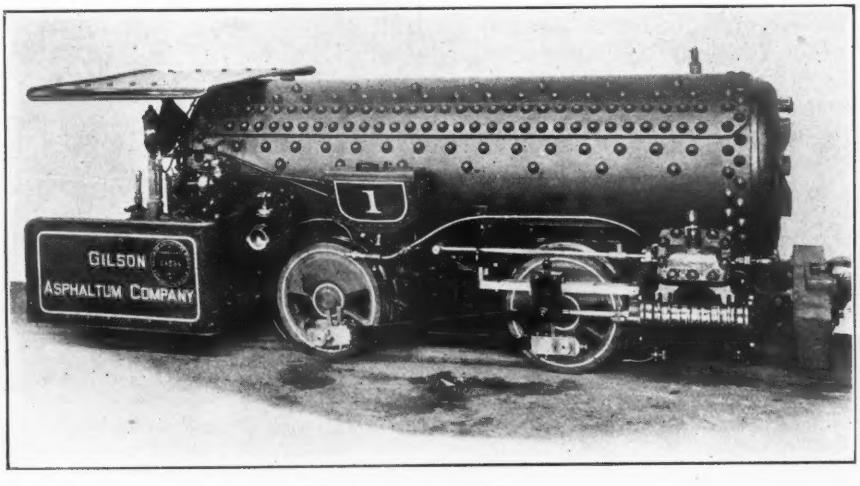



FIG. 2. GAGE 2′ 6″.

## DIVING APPARATUS FOR FLOODED MINES

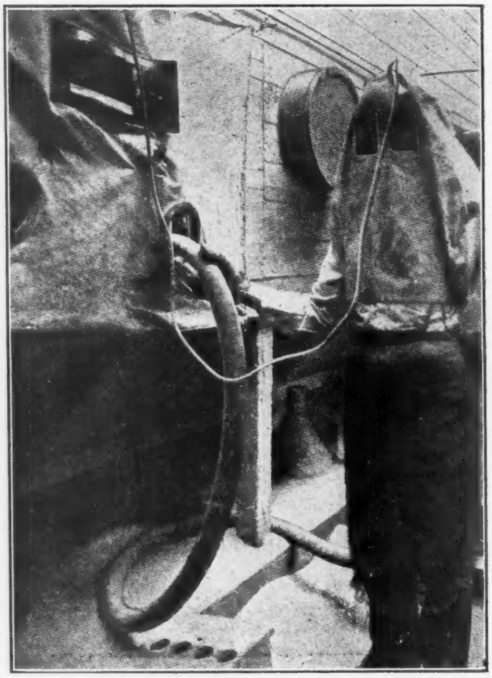
The self-contained diving apparatus shown in the accompanying half tone has been designed more particularly for work in flooded mines and other places where the use of compressors and tubes would be impracticable. It is suitable for work at depths down to 50 ft., the duration of air supply being about two hours at a time. The principle on which it operates is that the wearer breathes the same air several times over, the carbonic acid being absorbed from the exhaled breath and the requisite amount of oxygen restored to it, thus rendering it pure and fit for inhalation again. The apparatus, which is made by Messrs. Siebe, Gorman & Company, Limited, Neptune Works, London, S. E., consists of that Company's patent diving helmet and dress in combination with steel cylinders containing compressed oxygen and atmospheric air in certain proportions, and a metal chamber containing a substance which absorbs the carbonic acid of the exhaled air. Valves are fitted, which allow the air and oxygen to pass into the helmet and dress in the required quantity, no matter at what depth the diver may be working. There is also a safety device, whereby, in the event of a valve failing, the diver would be enabled to supply the requisite amount of air independently of the valves. Any excess of air that accumulates in the dress escapes automatically.

With this dress the ordinary weighted boots are worn, and also a lead weight on the chest, the usual back weight being unnecessary, as the steel cylinders carried there serve the same purpose.

The re-charging of the cylinders of compressed oxygen and air is done from large storage cylinders, and a pump connection for raising the pressure to the full 120 atmospheres in the cylinders of the diving apparatus is supplied. For use in places abroad, or where it may be impossible to get the steel cylinders charged, a portable oxygen-making and compressing apparatus is employed.

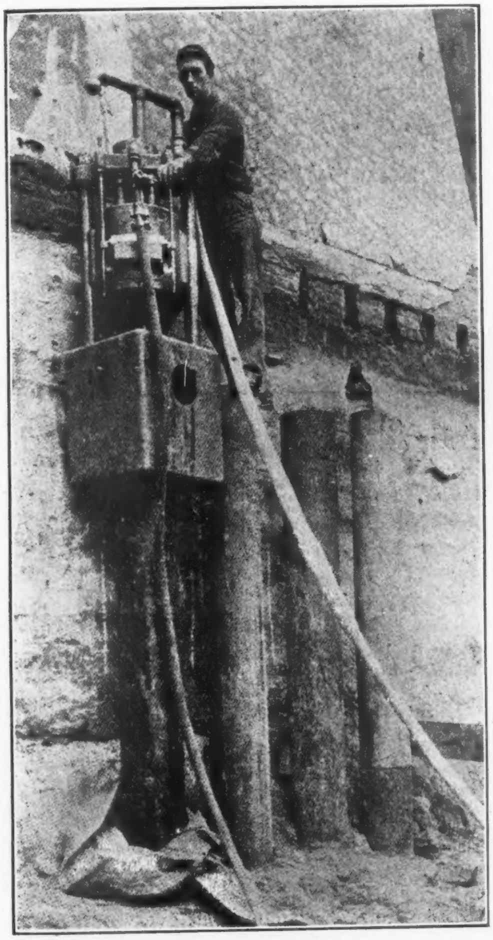
## PROTECTING THE SAND-BLASTER

The half tone here reproduced from the *American Machinist* shows the operator in the sand blast room of a big automobile factory as he looks when sand blasting cylinder castings. These are behind the canvas curtain



through which the hose is run, this being one of the arm-holes through which the operator sticks his arms and directs the sand-blast as he looks through the celluloid window above.

It will also be noticed that he is provided with a substantial hood and that a little hose runs through this which is connected to a low-pressure air supply, keeping the hood free from particles of dust which might be injurious to him. The protective arrangement here shown seems to be the most complete and effective yet brought to our notice, but no precautions which can be devised should fail of adoption if they give any promise of additionally protecting the workmen.



**DRIVING FOUNDATION TUBES IN A BASEMENT**

In a recent issue of *Engineering Record* from which our half tone is taken, is described the construction of a heavy concrete and steel safe-deposit vault in the basement of an occupied building in Wall Street, New York. The vault is entirely independent of the building structurally, its foundations having been carried through water and quicksand to solid rock, without any injury to the building and without inconvenience to its occupants.

A pit excavation was made for the vault and for a mirrored inspection space entirely suring it, and for the foundations or supports of the vault eight pile tubes were sunk through openings provided in the concrete floor of the excavation. The tubes had an outside diameter of 12¾ in., the metal being basic, open-hearth steel, 3-8 in. thick.

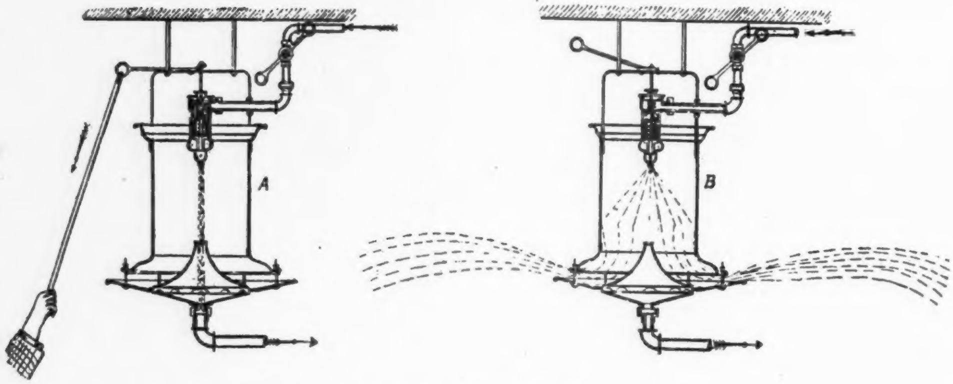
The sinking as shown in the half-tone was done by means of a Clark tubular hammer weighing 4,000 lbs. and striking 160 blows per minute. This was operated by air at a pressure of 100 pounds. As sinking progressed, material was removed from the tube by means of a water jet delivered throughg a 2-in. pipe working freely through the tubular piston of the hammer. The escaping stream of water and sand came out through the base of the hammer into a canvas boot and was delivered to the sump through hose of the same material. The jet was supplied by a Davidson plunger pump, the pressure being 110 lb. The boot was fastened tightly about the pile-tube, thus avoiding the necessity for a tight fit between the tube and hammer. By the time hard rock was reached the tube was free of fine material.

After the eight tubes had been sunk, such small boulders and other solid material as remained in the tubes, was blown out by means of air at 100 lb. pressure, which was discharged through a pipe having its open end at the bottom of the tube. The tubes extended to a depth of about 18 ft. below the cut-off level.

Two tubes were sunk in a nine-hour working day. The actual time of sinking a tube was one hour. The work of cutting off was done by a special machine, containing an air motor. A 1:2:4 mixture of concrete was used in filling the tubes, the stone employed being ¾ in. Each pile was capped by a 22x22-in. ribbed steel casting, having a thickness, above the pile, of 2 in.

The air hammer and tubes were handled by a derrick having a 15-ft. A-frame, and a 30-ft. boom operated by a Dake engine. Steam for the engine, for the Davidson pump and for the Ingersoll-Rand air compressor was furnished by a 100-hp. locomotive boiler, located in the street.

McKim, Mead & White were the architects, and the work was done by Clark & Company, Mr. F. L. Jenkins, Superintendent.




DROSOPHORE HUMIDIFIER.

## FACTORY HUMIDIFIERS

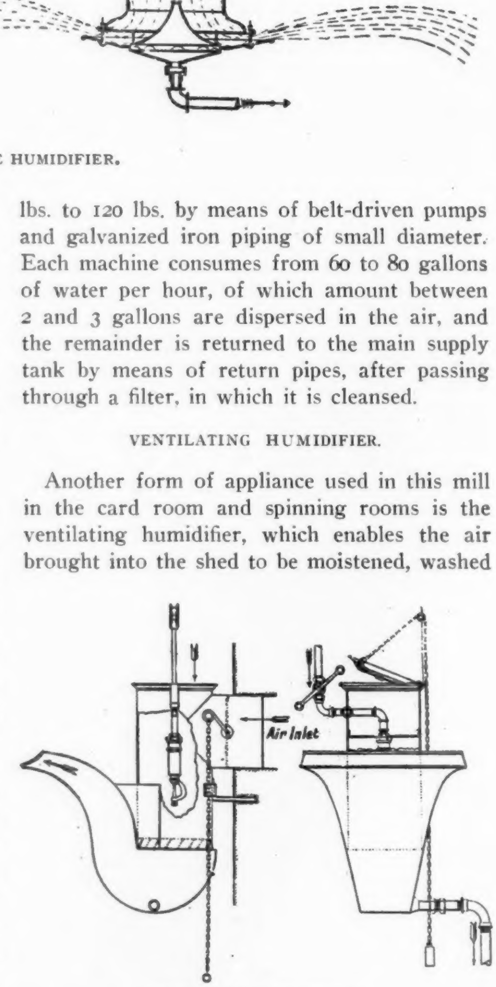
It is well known that a humid atmosphere is a necessity for cotton spinning and weaving. The position of Lancashire in this industry is understood to have been secured chiefly by reason of the moisture in the atmosphere of the district. Even here, however, it has been found highly profitable to increase the natural humidity by artificial means, and we here illustrate two apparatus employed for the purpose.

### THE DROSOPHORE HUMIDIFIER.

In the Drosophore system a machine is employed which produces the maximum degree of humidity, washes and purifies the air and gives off moisture in so fine a spray that the atmosphere absorbs it without dripping or wetting the machinery. The fine mist given off is produced by a very simple appliance consisting of a nozzle which is easily cleaned when necessary by the depression of a lever. This nozzle is placed in a cylindrical box about the size of the casing of an electric arc lamp. The casing is open at the top—see Fig 1—and round the bottom, and the action of the water coming through the nozzle is to create a partial vacuum, so that air rushes in at the top, passes through the fine spray, and out at the bottom saturated with a considerable amount of moisture. The illustration shows the appliance in operation and also shows the method of cleansing the nozzle. These appliances are suspended from the ceiling at suitable distances apart, the number required for each room depending upon the class of material produced and certain other conditions. They are supplied with water under a pressure of from 100 lbs. to 120 lbs. by means of belt-driven pumps and galvanized iron piping of small diameter. Each machine consumes from 60 to 80 gallons of water per hour, of which amount between 2 and 3 gallons are dispersed in the air, and the remainder is returned to the main supply tank by means of return pipes, after passing through a filter, in which it is cleansed.

### VENTILATING HUMIDIFIER.

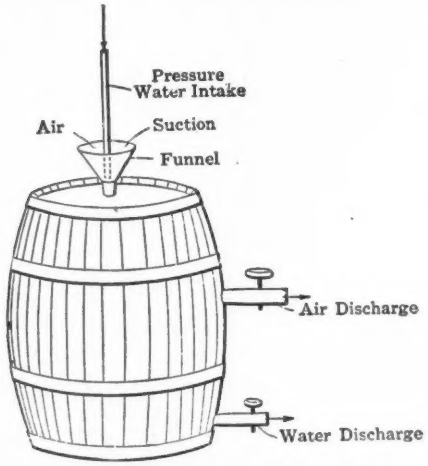
Another form of appliance used in this mill in the card room and spinning rooms is the ventilating humidifier, which enables the air brought into the shed to be moistened, washed




VENTILATING HUMIDIFIER.

and purified. A sectional view of one of these appliances is shown in Fig. 2. This is a U-shaped appliance, in which the incoming air has to pass through a water spray produced in a similar way to that in the apparatus above alluded to before being allowed to escape into the shed, where it is delivered in an upward

direction. The number of Drosophore machines in the weaving shed is sufficient to give the maximum amount of humidity required, and the ventilation is so arranged that the air is charged so as to have the humidifying installation under control. The humidifying machines in the centre of the room are placed at such distances as to give the requisite moisture, and the air is continually renewed by means of exhaust fans, which draw from the middle of the room. The pumps, which supply all the water for the Drosophore installation are placed in the mechanics' workshop, and are driven by belts from the main shafting. There are two pumps, one for the weaving shed and one for the spinning room, and each has its own system of piping, &c. The humidising apparatus was supplied by the Drosophore Company, Limited, Manchester.




## A HYDRAULIC AIR BLAST

A hydraulic air blast is easily rigged up where water under high head is available, and serves quite satisfactorily for affording ventilation, supplying the blacksmith shop, etc. Three holes are bored into a tight, strong barrel, one in the top and two on the sides, as indicated in the accompanying drawing. Into the one in the head of the barrel a funnel is inserted and fitted tightly. Pipes are tapped into the other holes and preferably some sort of valve or spigot arrangement provided on each. A smaller pipe connected with the water supply opens into the funnel, the end of the pipe being set a couple of inches above the throat of the funnel.

On turning on the pressure water, air is entrapped and forced into the barrel. The lower pipe serves for an outlet for the water and the upper one as an air discharge. By regulating the valves on the discharge pipes so that the water is let out as rapidly as it enters, and setting the end of the pressure-water pipe at the proper height above the throat of the funnel, a strong air blast can be maintained. The amount and pressure of the water admitted regulate the amount of blast obtained. On the 800-ft. level in the Pittsburg mine near Nevada City, Cal., such an arrangement is used with great success, water being taken from the pump column to operate the blast.—*Engineering and Mining Journal.*

## GRAPHITE FOR AIR CYLINDERS

The following letter was addressed to the editor of *Graphite*, from whose page it is here reproduced:

For the past ten years I have been using flake graphite on the air end of an air compressor and I want to tell you about it. When they started to put in this air compressor and I found out I was to have charge of it when installed, I read up on air compression. I soon learned that oil is a poor lubricant for the air end, even though the terminal pressure is low. But in this case it was necessary to have a temporary pressure by gauge of 120 pounds to start the column of water in the air lift system, and I found out by reading, that at this pressure the air is nearly at the melting point of lead, which is about 620 degrees Fahrenheit. I at once determined that as soon as the machine was turned over to me, I would use flake graphite, with as little oil as possible; for the very best of oil, I care not if it is valve oil of the highest quality, is a poor lubricant for air cylinders carrying 90 pounds gauge pressure or over.

This machine had been in use at another place when new, and had been taken out and placed in my charge after about six months use. At the first opportunity I took out the discharge valves and found them heavily coated with a deposit of carbon. These I cleaned of all deposit. I then turned my attention to the cylinder. On taking off the cylinder head I had found the inside of the cylinder scored in places, and looking very dry. I cleaned everything nicely, and made a dope consisting of a good quality of cylinder oil and Dixon's Flake Graphite, which I applied to the walls of the

cylinder. I have now been running this air compressor eleven years. A few days ago it was taken out and sent to the shop for general repairs. This is the first overhauling the machine has had in that time. I have used Graphite on all bearings of the machine as well as in the air cylinder. The air cylinder is in perfect condition, there are no signs of scratches or cutting, it is in as perfect condition as when started eleven years ago. There has been little deposit of carbon; not as much in ten years, as in six months when only oil was used in the air cylinder.

This is my plan of employing Flake Graphite in the air cylinder. Three times a week I take out the inlet valves, which are of the poppet type, and clean the same. Before returning to place, I take out a small quantity of flake graphite and mix with valve oil to make a thick dope. I then take a stick with a piece of rag wrapped around it to make a swab, dip it in the mixture of flake graphite and cylinder oil, and coat the inside of the cylinder. Between the intervals of cleaning the inlet valves, say three times a week, I allow the machine to inhale about a teaspoonful of dry flake graphite three times a week for a run of ten hours a day.

The piston rod on the air end has a beautiful polish, and does not show a wear of more than a good 1-32 of an inch in the eleven year run. In packing this rod, I have used Seldon packing cut in rings and smeared heavily with flake graphite and cylinder oil.

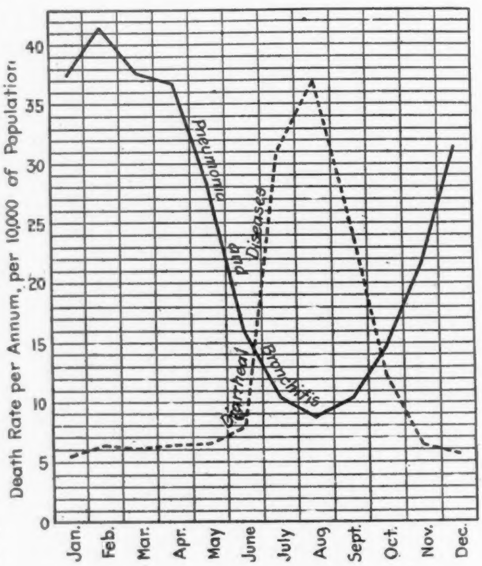
I would not attempt to run any machinery without a supply of flake graphite, and to prove how I value it, I have paid for it out of my own pocket for the past eleven years, as the railroad company by whom I am employed, does not furnish it.

A. H. Goff, Pumping Engineer,
Sanger, Tex.

## CHEAP PRODUCTION OF OXYGEN FROM LIQUID AIR

The following data on the production and utilization of oxygen from the air we obtain from a lecture by Mr. George Claude before the *Societe des Ingeneurs Civils de France:*

A plant with a capacity of 50,000,000 cubic meters (1,765,000,000 cu. ft.) per annum occupies a space 20 x 30 meters (about 65 x 100 ft.). Only 15 attendants are needed. For small apparatus (capacity 1,750 cu. ft. of oxygen per hour) 1 HP.-hr. is required for one cubic meter (35.3 cu. ft.) of oxygen. For larger apparatus (capacity 7,000 cu. ft. per hr.), the production is 1.25 cubic meters (44 cu. ft.) per horsepower-hour. The production is expected to rise to 1.75 cubic meters (62 cu. ft.) per horsepower in the largest apparatus projected but not built—(capacity over 35,000 cu. ft. per hr.). The total cost of production (Societe de'l Air Liquide) has been guaranteed at 0.6 ct. per cubic meter of oxygen (35.3 cu. ft.), including depreciation. For this figure power is secured at 0.4 ct. per HP.-hr. (as the company uses blast-furnace gas and internal combustion engines).

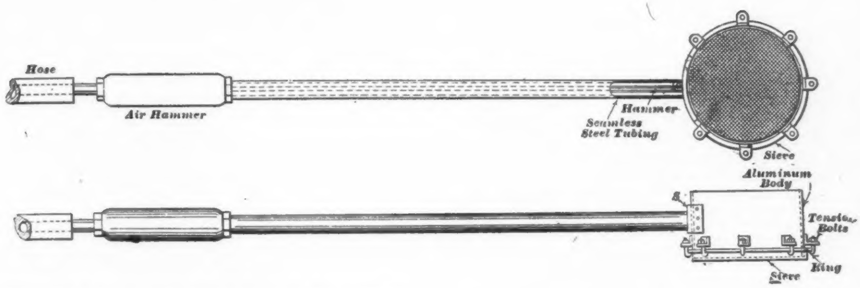



## AIR AND FOOD CONDITIONS AND THE MORTALITY RECORD

This striking little diagram from the *Weekly Bulletin* of the Chicago Department of Health tells its own story most effectively. The notes which accompany the diagram so published are as follows:

Impure-air Diseases, Pneumonia and Bronchitis.—High in winter when people house themselves up and breathe the foul air of unventilated rooms. Low in summer when people keep their doors and windows open, when people live more in the open air.

Impure-Food Diseases, Diarrheal Diseases.—High in hot weather chiefly because of dirty milk for babies' food and contamination of foodstuffs by flies, dust, etc.




### A PNEUMATIC DREDGE OR SIFTER

The cut herewith, adapted from *The Foundry,* shows a pneumatic dredge or sifter as used in enameled ware factories for distributing the enamelling powder over the heated castings. The body of the sieve is made of aluminum, to which angles are riveted with openings at their projecting ends. Brass wire cloth, 40 to 60 mesh, is placed over the bottom of the body, and a ring is drawn up over it, so as to hold it firmly in place. A wrought iron plate is fastened to the body at *S,* and to this is attached a section of seamless tube, at the other end of which is fastened a vibrator. This vibrator consists of a steel rod which contacts with a little rapidly reciprocating plunger transmitting the vibration to the plate, and this in turn vibrates the sifter. This plate should be of considerable thickness, as otherwise the constant hammering will soon distort it. These vibrators can be purchased from manufacturers of pneumatic tools. The air hose is attached at the end, as shown.

### COMPRESSED AIR IN A SAW MILL

The Portland Lumber Company, Portland, Oregon, has installed an air compressor in the mill, and the superintendent, Mr. S. B. Stewart, writes to *The Timberman* about it as follows: "We are using compressed air on the edgers, bumpers, pickups, jump saws and trimmers. The operator operates his bumper just as well if it is fifty or sixty feet from him as if it is close to hand. All that is necessary to have between the bumper and the operator is a half inch pipe to convey the air from the valve to its location close to the cylinder of the bumper; besides, the air is rather quicker than a lever would be. We installed a 12x12 compressor, as we desired to use air to a more or less extent throughout the mill. We carry 30 pounds pressure on the trimmer, and expect to use about the same pressure on the bumpers and pickups. We use air for cleaning purposes in our planing mill as well as in the saw mill and carry it to the planing mill about 100 feet distant. When steam is conveyed a long distance it becomes sticky and wet, and for cleaning purposes tends to make the dust stick rather than remove it. With compressed air the removal is rapid.

"One of the most important advantages of the use of air over steam is that the lever required to operate the compressed air valves is very small, probably not more than 2 or 3 inches. The trimmerman operates the levers with one finger. Another advantage compressed air has over steam is the fact that in the manipulation of the lever there is no physical exertion necessary. Experience in handling men everywhere has shown that men who use their brains must be relieved as far as possible of physical exertion to get the best results. Another good feature of the use of air on the trimmer is that it increases its capacity on account of its rapidity of operation. I believe we can put at least 25 per cent. more lumber over our trimmer operated by air than by steam.

"In the installation of our trimmer the saws are counterbalanced, and as a result it only takes a mere fraction of air in order to operate the saw. One putting in compressed air to be used on the trimmer only would be required to put in only a small compressor, and the necessary outfit would cost less than the old steam rig.

"In substituting air for our trimmer we took out nearly a drayload of machinery. In its place we simply put in a half inch pipe from the manifold to the saw. Attached to each saw is a small cylinder made of 3-inch brass pipe with a cast base. The pipe from the manifold is tapped into the cast base. The top of the

head is open the same as an ordinary well valve. They are very easily made and at a low cost. We do not require any stuffing box, merely a plain pump cylinder. We are also rigging up the trimmer to cut odd lengths by simply putting in another saw at the head of the trimmer one foot away from the first saw."

## AUTOMATIC PURIFICATION OF NATURAL ICE

The following we take from a paper by Mr. Harold W. Cole, before the Natural Ice Association of America:

There are two stages in the purification of natural ice. The first is that brought about by the process of freezing itself; and the second the action which takes place in the ice after the ice is stored in ice houses. Ice is formed as a crystal on the surface of water, and the act of crystalization is invariably an act of purification. Numerous investigations, have shown that ice formed on water, part of which remains unfrozen, is from 90 per cent. to 99 1-10 per cent. purer than water was before the water was frozen. After the ice has eliminated both bacterial contents, solid contents and various chemical constituents by means of crystalization there remains a very small and practically negligible quantity of impurities in the ice. It would be entirely negligible if it were not for the fact that it may contain some bacteria, but if the ice was cut properly and stored in ice houses, as the majority of ice is before it is used, anywhere from one to two or three months, there is another process going on which results in its almost total purification. Bacteria are inured to a temperature about equal to that of the human body, 98 and a fraction degrees Fahrenheit; in addition to that the bacteria move about freely, and the majority of them require a certain amount of oxygen in order to live, and they require food in order to live. It will, therefore, be perfectly reasonable to suppose that if you take a number of bacteria and freeze them in a cake of ice so that they cannot move around, and therefore cannot seek out food and cannot get any air and are at a temperature of some 60 degrees or 70 degrees lower than that at which they were meant by their nature to live, they cannot live.

Numerous tests made by various scientists in several parts of the country have shown that of the small percentage of bacteria remaining in natural ice, when put in the house, less than 1 per cent. remain after storage of from six to eight weeks, and after a period of from twelve to twenty weeks no living bacteria are found bearing any disease. As a result of these investigations the State Commissioner of Health of the State of New York, in agreement with the Health Board of the State of Massachusetts, has publicly announced that there has never been a case of disease brought about by the use of natural ice, and that, as the New York State Commissioner says, ice cannot be from its nature and from the method of harvesting the bearer of disease.

## FARTHEST NORTH POWER PLANT

Very near to North Cape, Norway, latitude 70, north, or at least one degree further north than Point Barrow the extreme reach of Alaska, is located a completely up-to-date steam power plant. This installation has followed the discovery of valuable deposits of iron, the ore being of such a character that shipment before treatment or concentration was impracticable.

The plant comprises, in the main room two 3750 brake horsepower De Laval multisage steam turbines, each direct connected to an 850 volt three-phase alternating current generator, developing a maximum of 2,625 kilowatts. On a lower floor are located one 360 brake horsepower De Laval steam turbine direct connected to a 240 kilowatt three-phase alternating current generator and one 180 brake horsepower direct connected to a 120 kilowatt generator. There are also two motor driven sets, these units being used for excitation purposes.

The boiler plant consists of five 500 horse power Babcock & Wilcox water-tube boilers with two economizers. The boilers are also equipped with superheaters and mechanical stokers. There are four high pressure De Laval Zeta pumps of 250 brake horse power each, and several small pumps used for various purposes. The condenser air pumps are located in the basement and are motor driven by means of noiseless chain belts. The buildings and entire equipment are perfect in their line and the plant as a whole is a fine example of the latest in steam and electrical engineering. The current generated is employed for the magnetic separation of the ore, about 600,000 tons to be shipped annually. The ore bed is said to have at least 400,000,000 tons available.

# COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Established 1896

W. L. SAUNDERS, - - - - - - Editor
FRANK RICHARDS, - - Managing Editor
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CONTENTS



## MECHANICAL INVENTION, DISCOVERY AND EXPLORATION

Mechanical or industrial inventions, such, for instance, as are usually the subject of letters patent, seem to be of two quite distinct types, so essentially unlike in fact that they may perhaps be better differentiated and distinguished by using different words in speaking of them. To the one, and the most numerous, class the word "invention" intelligibly applies, while those of the other class may be more correctly designated as discoveries.

In the one case the inventor sets out to accomplish some definite result, usually by mechanical agencies, and for this he selects combinations of operative devices, mostly familiar in detail, but which accomplish the new result desired. Of this class of true inventions are the typewriter and the sewing machine, and, in a larger way, the locomotive. They are each a wonder as a whole, but in ultimate detail the devices employed have generally been known and used long before. These inventions are always possible to persevering cutting and trying, to continuous selecting and rejecting, and usually many men co-operate, often unknowingly, to elaborate the final and completely successful apparatus.

The inventions of the other class, the discoveries or "happy thoughts," are recognizable by all as essentially different from these. They come to the few; they come in their entirety at once; they come unheralded; but they do come to those who are alertly and intelligently seeking such things rather than to those who are not so on the lookout. Sometimes the discovery is that of an important detail of a more or less familiar but constantly improvable machine, as, for instance, the piston inlet of the air compressor. Such a discovery as that bars all imitation; you either have it or you have it not, and, when priority of discovery is established, it completely protects itself against all infringement.

In the discovery class we must place also the Electric-Air Drill. It combines a single happy thought which is the central and dominating idea of the apparatus as a whole, and the discovery of it must have come all at once, although we may assume that it came to one who stood alert to see and quick to recognize it.

The discovery analogy extends beyond the first incident of perception, recognition and appropriation. After the discovery becomes an

accomplished fact the thing discovered must still be investigated, and, as we might say, explored, that all its bearings and relations may be known and all its accompanying advantages made available, just as an island or a continent newly discovered must be explored and mapped. To the explorer surprises come, and it often happens that he finds the world more enriched by the new discovery than was at first realized. Analogous to this are the revelations which experience brings concerning the Electric Air Drill.

When the idea of it was first entertained it was evident at once that here was provided at least the possibility of dispensing with air compressor plants and long lines of piping in mining and other rock cutting operations. In the adoption of revolutionary improvements it is seldom that it is all clear gain. There are usually sacrifices or compromises to be made, and before the final adoption of the Electric Air Drill these were to be looked for. They have not been found. The drill in working is not in any respect inferior to the drill driven by constant air pressure. The drill itself is much simplified, the most troublesome and costly details both in construction and maintenance having been eliminated. The drill actually strikes a harder blow, because the air from one pulsator follows the piston with an increasing pressure while the other pulsator makes a decreasing pressure on the other side of the piston. The drill practically forgets its old habit of sticking in the holes, because the pulsators keep the air yanking at it, one side and then the other, so that if it does stick for a moment it is free again before anything can be done about it. The most surprising thing of all is that the Electric Air Drill requires much less than one-half the power, at the source of power, which the direct air operated drill requires to do the same work. The power economy of the drill is easily explained upon investigation, but it was practical experience instead of theorizing which first revealed it.

## RAPID AND WONDERFUL AEROPLANE DEVELOPMENT

In all the history of mechanical achievement it would be difficult to find a parallel to the combination of intelligence and audacity with which a few men, in as few years, have lifted the art of flying from the dreamland of the impractical enthusiast into the world of brilliant accomplishment. It was not so very long since that a scientist of world-wide reputation attempted to prove that, because of certain fundamental principles, the art of flight by means of heavier-than-air machines was not commercially practicable. Nevertheless, within a period of considerably less than a year, more than one aviator has flown at a speed of over forty-seven miles an hour; another has covered a distance of 144 miles in a continuous flight of four and a quarter hours; a third has flown across the English Channel; and a fourth, Paulhan, the most distinguished aviator of them all, has soared nearly a mile into the air, and finally has surpassed even that feat by flying from London to Manchester, covering a distance of 186 miles, with but one stop for fuel, at an average speed of over forty miles an hour.

The significance of this really wonderful race between Paulhan, the Frenchman, and White, the Englishman, is apparent only when we consider some of the details which have been cabled to this side of the Atlantic. That Paulhan should have won the $50,000 prize in such superb style, at the very first trial, is a tribute both to his own skill in manipulation, and to the excellence of the Farman biplane with which the race was won; but to appreciate the full significance of the race, we must remember that both contestants, and particularly White, flew for a considerable stretch of the journey at night time, and, what is of even more importance, that they did not hesitate to make both the ascent and the descent in the darkness. No stronger evidence than this could be afforded that the aeroplane is an instrument of precision, which can be relied upon to answer with certainty to the controlling hand of the operator.

There is something strongly suggestive of bird-flight in the description of the manner in which one of the contestants, after leaving the ground, swept through the air in a wide circle in order to get the lay of the land and the proper direction of flight, or to pick up again a course from which he had been driven by the wind. But certainly the most difficult feat of all was that of making a landing at night time, in a locality with which the aviator was quite unacquainted, and where he had to make a wide detour, looking for a suitable stretch of unobstructed surface on which to alight.

Last year, in commenting upon the status of the art of flying, we pointed out that the one last obstacle to be overcome, before flight could be reckoned among the practical achievements, was that of successful starting and alighting upon the average surface which would be encountered in cross-country flying, and performing these feats with certainty in a breeze of ordinary strength. The London-to-Manchester race would certainly seem to prove that this important stage in the development of human flight has been reached and successfully passed.—*Scientific American.*

## DINNER AND PRESENTATION TO DR. RAYMOND

One of the most notable events of its kind which the technical press has ever had the pleasure of recording, was the gathering at the Plaza Hotel, New York, on the evening of April 30th, of about 400 eminent scientists and personal friends of Dr. Rossiter W. Raymond in tribute and congratulation in commemoration of his 70th birthday and the completion of his 30th year of continuous service as secretary of the American Institute of Mining Engineers.

Of Dr. Raymond's range of accomplishments and the reach and completeness of his life record, our readers need not a word of reminder. It has only recently been aptly said of him: "It is an open question whether he plays chess better than he plays whist, or writes hymns better than he composes stories for children, whether he is stronger as superintendent of a Sunday school or as leader in the jiu-jitsu of a mining law suit, whether the preaches in Beecher's pulpit better than he lectures at Columbia, whether he talks more convincingly than he writes, and, finally, whether he is a great mining engineer or only a great man."

Among those who united in the tribute on this occasion were: Dr. James Douglas, E. G. Spilsbury and Jas. C. Boyles, past presidents of the organization of which Dr. Raymond also is a past president as well as its secretary; Dr. Lyman Abbott; George Westinghouse, president of the American Society of Mechanical Engineers; John A. Bensel, president of the American Society of Civil Engineers; Rawlinson Tennant Bayliss, vice-president of the British Institution of Mining and Metallurgy, who presented to Dr. Raymond the gold medal of that society; Sorzano de Sajada of the Societé des Ingénieurs Civils de France; John Fritz; Frank Dawson Adams, president of the Canadian Mining Institute; Geo. W. Maynard; Robert W. Hunt; Thomas Commerford Martin, past-president of the American Institute of Electrical Engineers, and William Lawrence Saunders, president of the Ingersell-Rand Company.

Dr. Douglas presented two handsomely illuminated parchments from the Iron and Steel Institute and the Vereinsdeutscher Eisenhüttenleute. After the reading of resolutions passed by the British Institution of Mining and Metallurgy and Société des Ingenieurs Civils de France by their respective representatives, and at the conclusion of Dr. Raymond's response, a large floral mound, built up to suggest a western mine with the buildings, smelters and workmen's homes, was parted and disclosed a silver service, which was presented to the guest of honor and his wife.

The unique function of this notable occasion was the presentation by Mr. Saunders of forty-seven American Beauty roses to Mrs. Raymond in commemoration of forty-seven years of married life. Mr. Saunders address was as follows:

All honor to our guest, but it falls to my lot to speak of one who is preferred before him; of one who at this feast is as welcome as the flowers in May.

Lord Burleigh in giving advice to his son, said, "Use great prudence and circumspection in choosing thy wife, for from thence will spring all thy future good or evil."

Forty-seven years ago was a critical period in the life of our guest: Young, able, ambitious and yet strong in faith and love, he knew that the glory of young men should be their strength, and so towering in the confidence of twenty-three he plucked from highest boughs this "flower of wifely patience."

If the gospel be true, that "a prudent wife is from the Lord," then

"There's in you all that we believe of Heaven,
Amazing brightness, purity and truth,
Eternal joy and everlasting love."

Look back, sir, through the pleasures of memory on the events of nearly half a century of your active life; think of your greatest joys; recall the applause of the multitude, the honors bestowed, the pomp of power, the satisfaction gained by prosperity, happiness and through

troops of friends, yes, even up to this night which should be a proud moment to any man, yet you will not deny that after all "there's nothing half so sweet in life as love's young dream."

There is a beautiful song called "Let me dream again," in which are the words: "O, do not wake me, let me dream again." To you love's dream has had no awakening since that bright morning when you sailed forth upon the sea of life, with this "gentle, trusting, loving wife."

The story is told of a man who led in everything. He was the captain of the ball team; the leader in his class; the county chairman and the deacon in the church. In due course he took to himself a wife, and a friend who knew him well was asked how he was getting along since he married. He always led everyone and it was said that no woman could ever get ahead of him. "Oh," said the mutual friend, "he is still leading, I suppose, but his wife is just behind holding the reins."

We drink to her who is *his* wife and long may she reign!

Here's health to her,
Here's wealth to her,

to her who is his guide, philosopher and friend; to her who is more than a star, for she is a constellation of virtues, she is the comet and he, why he is only the man in the moon! To her, to her!

On behalf of his friends and yours it is my privilege to lay these flowers at your feet.

Here is a rose for you for every year of wedded life: It lifts its face above the thorns as you have always done, as you do now.

"Here, mark you, where the bolt of Cupid fell:
It fell upon a fragrant little flower,
Before, milk-white, now crimson with love's wound."

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Compressed air in the foundry serves many uses: operates molding machines, air hoists, either independent or in combination with jib cranes, sand sifters, rammers, chipping hammers and sand blast for cleaning castings, pushes core oven cars into and out of the ovens, promotes combustion in melting furnaces.

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The water temperature at the Ward shaft on the Comstock lode is 160 deg. Fahrenheit.

## CONTINUOUS FILTRATION OF BATH WATER

At the Rotherhithe baths, in London, the water, which normally would require frequent renewal, is used over and over, a system of continuous filtration and purification being employed which possesses demonstrated economical and hygienic advantages. There is a cast iron tank of filter gravel, which is cleansed every few days by blowing water and live steam through it, and an aerator on the roof consisting of perforated zinc trays. Dirty water from the swimming tanks is raised to the aerating tower where it receives a fresh supply of oxygen and then passes down through the filter. The filter effluent passes through a heater, which uses the exhaust steam from the pumps and raises its temperature to 74 deg. Fahr. The plant circulated 20,000 gallons per hour, changing the entire contents of the swimming tank every 4½ hours by this continuous circulation. The body of water used is actually renewed only twice during the summer and once in the winter.

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## CLEANING SHOULD BEGIN AT HOME

A dozen launderers are looking into the advisability of investing in a vacuum cleaning outfit for the purpose of cleaning for other people and for pay, while there are a hundred dozen launderers whose plants are looking as though they ought to employ someone to come in with a vacuum cleaner and take some of the dust out. They will go through the nonsensical operation of stirring this dust up every day so that the finest of it can get a short vacation from the floor, to spend on the various garments lying or hanging about, and on other surfaces, calling this operation cleaning, when it is simply transferring the dust from the floor (where it would do less harm, really) to where it certainly should not go. And all of this when the dust could, at slight expense, be taken entirely out of the premises. Wonder why?—*National Laundry Journal.*

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## NOTES

The Chicago office headquarters of the Ingersoll-Rand Company is now in Suite 1503-1505-1507 People's Gas Building, 150 Michigan avenue.

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We have received the first issue, May, 1910, of *Foundry News,* published by the Foundry

News Company, 50 Church street, New York. It is an attractive and every way excellent number and shows the editor to be fully in touch with the up-to-date foundry.

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The general offices of the Sullivan Machinery Company have been moved from the Railway Exchange Building, Chicago, to Suite 413, People's Gas Building, 150 Michigan avenue.

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The Aëro Club of America has secured quarters in the Engineering Societies building, 29 West 39th street, New York City, which now forms the home of twenty-five engineering and scientific bodies with some 30,000 members.

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When Halley's comet was nearest the earth the two bodies, going in opposite directions, passed at a speed relative to each other of about 2,500 miles per minute.

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Fort Worth, Texas, is now supplied with natural gas from the Henrietta fields, 95 miles away. The quality of the gas is excellent, the wells are large and the pressure is enough to send it several times the distance.

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A company is being formed in Winnipeg with the object of establishing a plant for the supply of steam, hot water, and compressed air by means of underground conduits, and an application has been made for the necessary powers. The boiler plant will probably be erected on the Red River close to the busy portions of the city, and will be of 5,000 horsepower.

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On the property of a single marble company in North Georgia are deposits of marble which as far as they have been prospected, are capable of yielding 1,000,000 cubic feet of the material a year for 4,000 years. No idea of the depth of the deposit is had, and one of the quarries has already gone down nearly 200 feet without there being any indication that the bottom of the deposit is being approached.

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The method of boxing the compass by reading the numbers of the degrees all around from north, starting to the right, is being seriously considered with a probability of adoption by the United States Navy. East would, of course, be 90 degrees; south, 180; west, 240; and north, 360; and all intermediate points as thus indicated. There would be no more west-sou-west, no'th-east-by-no'th or the other picturesque nauticalisms.

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The United States lighthouse officials for the Pacific Coast have decided to construct no more lighthouses, but to establish acetylene gas beacons similar to those which have been used for some time in Canadian waters along the coast.

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The various states in Australia have for some time had laws on their statute books requiring mine managers to provide water sprays where necessary to allay the dust from drills or other sources in order to prevent miner's phthisis. These regulations have not been strictly enforced of late, with the result that the spread of the disease has been alarming, and steps are now being taken to insure the proper observance of the law in all cases.

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A series of experiments was recently made at Johns Hopkins University to determine the dielectric strength of air. It was found that the point at which a brush discharge occurred is only slightly affected by the moisture in the air. From dry air to saturated air there is a drop in voltage of the discharge of less than 2 per cent. An increase of temperature from the freezing point to 40 deg. Cent. caused the lowering of voltage by about 3 per cent.

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A coal dust burner using a jet of compressed air instead of a fan blast has been in successful operation for the past two years in a southern cement factory. Air at high pressure passes through a Koerting ejector nozzle and enters the kiln through a horizontal pipe. A vertical fuel supply pipe opens into the horizontal pipe just beyond the discharge end of the nozzle and between the nozzle and the kiln, the rapidly moving air jet carrying the coal dust into the furnace.

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Aerial appartus seem to be rapidly attaining commercial status. An English motor supply company with an aviation department publishes a catalog of aeroplanes with full descriptions and prices. The Bleriot monoplane can be had for about $2,500, and a Farman biplane for from $4,200 to $5,500, the price varying considerably according to the engines

provided. The Santos-Dumont monoplane may be bought for a mere $1,500, while the Wright machine commands a price of from $5,500 to $6,000.

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The three engineers appointed by the Canadian government to consider the application of the St. Lawrence Power Company for permission to dam the Long Sault Rapids at Cornwall, Ontario, report that the enterprise is worthy of most serious consideration. They urge that, before the government approval is given, there should be a complete agreement between Canada and the United States as to the supervision and control of plants on both the Canadian and New York State banks of the river.

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Although amounting by weight to only about 0.034 per cent. as against 21 of oxygen, the carbonic acid in the atmosphere shows surprisingly powerful chemical properties. Under conditions controlled by the chemist, carbonic acid may be regarded as the weakest of inorganic acids, but when dissolved in surface or other waters, and particularly when absorbed merely by moisture where it has the maximum surface action, it possesses the power of gradually decomposing most of the rock-forming silicates.

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What is claimed as the largest and most powerful windmill in England has just been completed at Willesden, where its capacity is being tried under varying conditions. It is intended for a farm near Bristol, its use there being to generate electricity, supply power to run crushing machinery and work the pumps. From the trials made it is said this new wind machine is capable of generating sufficient electricity for 300 lights, to crush oats and grind maize, work an electric lift, cook the food, and heat a room at a cost of ½d. per unit.

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Among the foundation industries of the United States mining ranks second only to agriculture. It now contributes over $2,000,000,000 annually to the national wealth, as compared with $7,500,000,000 from agriculture; but it contributes 65 per cent. of the freight traffic of the country, as compared to 8½ per cent. from agriculture. Its manufactured products in 1907 amounted to a total of $4,318,598,661, and the wages paid to the men engaged in such manufacture amounted to $863,558,487, as against $735,101,760 paid to those engaged in agriculture.

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Passenger subways under busy street intersections, to enable pedestrians to cross the street safely are being constructed in London at the so-called "Elephant and Castle." These street subways consist of tube tunnels 8 ft. inside diameter. Stairways lead down to these tubes, and an underground room 20x23 ft. at the junction of the tubes enables passengers to cross in different directions without crowding.

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Calcareous nitrogen containing 20 per cent. nitrogen costs for its production from $47.27 to $55.15 per short ton. This makes the actual nitrogen in the compound cost 11.8 to 13.6 cents per pound, while the cost of nitrogen in compounds formed by the direct combination of the elements in the air is generally conceded to be less. The experiments made with fertilizers of either system, in comparison with Chilean saltpeter, are generally favorable to the artificial product. In sandy soil the calcium nitrate formed by the direct combination of the elements in the air brought even better results than the Chilian saltpeter.

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The United States Geological Survey has completed a line of spirit levels through Death Valley, California, and, much to the surprise of every one famliar with the region, has ascertained that the depth of that area is not so great as was supposed. Preliminary figures give for the lowest point a depth of 276 feet below sea level. The Geological Survey now has elevation marks on the highest and lowest points of dry land in the United States. It is a strange coincidence that these two extremes are both in southern California and only 75 miles apart. Mount Whitney is a foot or two over 14,500 feet above sea level, while Death Valley, as above stated, is 276 feet below.

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A committee of engineers appointed by the Roads Improvement Association of England to examine various sections of road which had been sprinkled with calcium chloride solution to lay dust has just rendered a report. The committee says that the treatment has the ill effect of causing, during the winter months, an ab-

normal quantity of sticky mud, a decided tendency to licking up, and a disintegrating action upon the macadam surface. Nevertheless the committee concludes that the calcium chloride solution is probably not more injurious to the macadam roads than the excessive water now demanded by the public in order to keep the dust down.

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The total rainfall of the United States, including snow and that on water areas, has been given by Dr. M. J. McGee, secretary of the Inland Waterways Commission, as 215,000,000,000,000 cubic feet a year. Half or more is evaporated. About one-third flows into the sea. The remaining one-sixth is either consumed or absorbed. Of the 70,000,000,000,000 cubic feet flowing annually into the sea less than 5 per cent. is used for power. It is estimated that from 85 to 95 per cent. of the volume is wasted in freshets or destructive floods. The theoretical power of the streams is over 230,000,000 horsepower. The amount now in use is 525,000 horsepower. The amount available, at a cost comparable to that of steam installation is estimated at 37,000,000 horsepower.

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In the 31-day period from the morning of March 3 to the morning of April 3, No. 1 shaft on the Moodna Siphon of the New York City Catskill Aqueduct, near Cornwall, was deepened 177 ft. The shaft was about 365 ft. deep on March 3. This is claimed by the contractors as a new record for American shaft sinking. The shaft is circular, with a minimum allowable radius of 7 ft. 11 ins. and an average diameter of about 16 ft. 8 ins. The shaft was sunk with one eight-hour drilling shift and two eight-hour mucking shifts daily. Thus 19 shifts were worked per week, two being lost on Sundays. The rock penetrated was hard Hudson River shale. Mr. Walter Steenburgh was in charge of the work described, under the general supervision of Mr. Francis Donaldson, Chief Engineer for the contractor, the Dravo Contracting Co.

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The ordinary form of liquid bath for the determination of melting points has been modified by the introduction of an air-bubble system, causing a rapid circulation of the liquid, and hence a uniform temperature. The same idea has been very ingeniously applied by Mr. H. Stoltzenberg—*Zeitschrift für physikalische Chemie,* March 11th—in designing a low-temperature coling bath. The liquid—pentane—is caused to circulate by means of hydrogen bubbles through a spiral dipped in liquid air, ether and solid carbon dioxide or a mixture of ice and salt, according to the temperature required, and then passes into the vacuum-jacketed vessel in which the measurements are carried out. The temperature can be easily regulated by altering the amount of the spiral immersed, and can be kept very constant.

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The use of compressed air for raising sunken ships is no longer a novelty in any part of the world, a recent instance being that of the steel steamer Fleswick, in Cork harbor, Ireland. The wrecked vessel, which was 180 ft. long by 28-ft. beam, rested on her side in 27 ft. of water forward and 39 ft. aft, on a muddy bottom. The coal which formed her cargo was first taken out with a grab bucket and plate scraper, and then the hull was made as nearly as possible air tight by closing the hatches with steel plates placed by divers. Air was pumped in, but owing to the dip of the ship's stern, more of the air went forward than aft so that a hulk had to be used to assist in lifting the stern off bottom. The ship was floated and uprighted with the assistance of a barge near shore. She was then docked, and after some temporary repairs was taken to Liverpool.

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White gunpowder is seldom heard of because is does not lend itself to general use. It consists of a mixture of two parts chlorate of potash, one of loaf sugar and one of prussiate of potash. These are reduced to a powder and then mixed while dry. Its explosive power is very great but it is not safe, exploding on slight jar.

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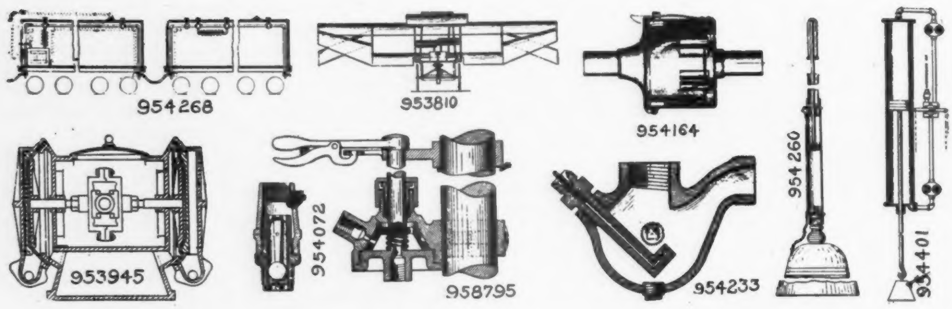
## LATEST U. S. PATENTS

*Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.*

APRIL 5.

953,795. AIR-VALVE FOR PNEUMATIC CONTROL SYSTEMS. LAWRENCE S. NASH, Detroit, Mich.




PNEUMATIC PATENTS, APRIL 5.

953,810. FLYING-MACHINE. EDWARD J. AUGSBERGER, Philadelphia, Pa.

953,945. VACUUM MEMBRANE-PUMP. MARTIN FALK, Cologne, Germany.

954,072. FLUID-PRESSURE REGULATOR. ADOLPH G. BECKMAN, Baltimore, Md.

954,164. ATTACHMENT FOR VACUUM-SWEEPERS. JOHN BROEKEMA, Rogers Park, Ill.

954,231. CAR-DOOR BURGLAR-ALARM. GEORGE A. ULRICH, Guadalajara, Mexico.

954,233. SAND-DISTRIBUTER FOR LOCOMOTIVES. HARRY R. WASEM, Fort Dodge, Iowa.

954,260. DUST-BLOWING ATTACHMENT FOR BROOMS, BRUSHES, AND THE LIKE. FRANK C. DAVIS, Tucson, Ariz.

954,268. PLANT FOR THE HANDLING AND UTILIZATION OF LIQUID AIR AND THE LIKE. HORACE DUMARS, Glen Ridge, N. J.

954,401. FLUID-ACTUATED BALANCED HOIST. GEORGE F. STEEDMAN, St. Louis, Mo.

2. A fluid-actuated balanced hoist, provided with a piston that is adapted to move a load, means, for creating a uniform pressure on both sides of the piston to cause it to move in one direction, means for reducing the pressure on one side of the piston to cause it to raise said load, and means for cutting off the supply of fluid to both sides of the piston to hold the piston at rest between its two limits of movement.

APRIL 12.

954,451. DESICCATING APPARATUS. IRVING S. MERRELL, Syracuse, N. Y.

954,550. LIQUID-GAGE FOR PRESURE-TANKS. ARNOLD VERHOEVEN, Marianna, Ark.

954,560. DUMPING-CAR. CARL P. ASTROM, Hasbrouck Heights, N. J.

4. The combination with a dumping car-body mounted to tilt on trunnions of a cylinder and piston connected to actuate said car-body, a stationary checking piston within the actuating piston, and means for regulating the passage of fluid between the sides of said checking piston to control the speed.

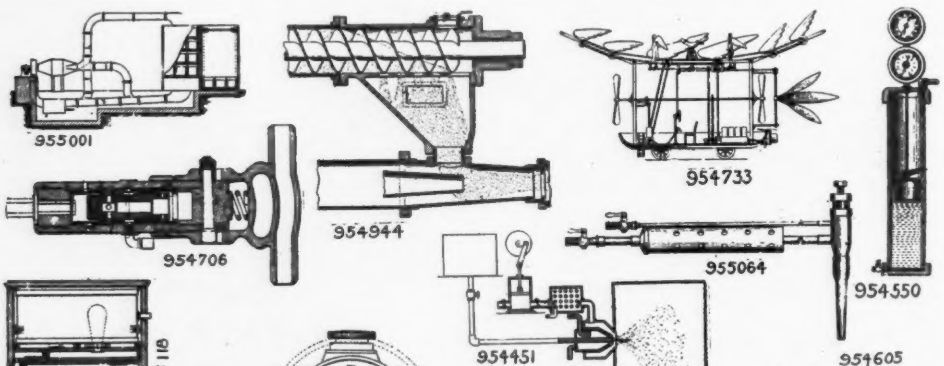
954,574. MEANS FOR STEERING FLYING-MACHINES. ALBERT KOEGLER, San Francisco, Cal., and KAMILLO STELZER, JR., Dresden, Germany.

954,605. FLUID-COMPRESSOR. WARREN W. ANNABLE and JOHN W. FITZGERALD, Grand Rapids, Mich.

954,706. ROCK-DRILL. GRANT W. SMITH, Chattanooga, Tenn.

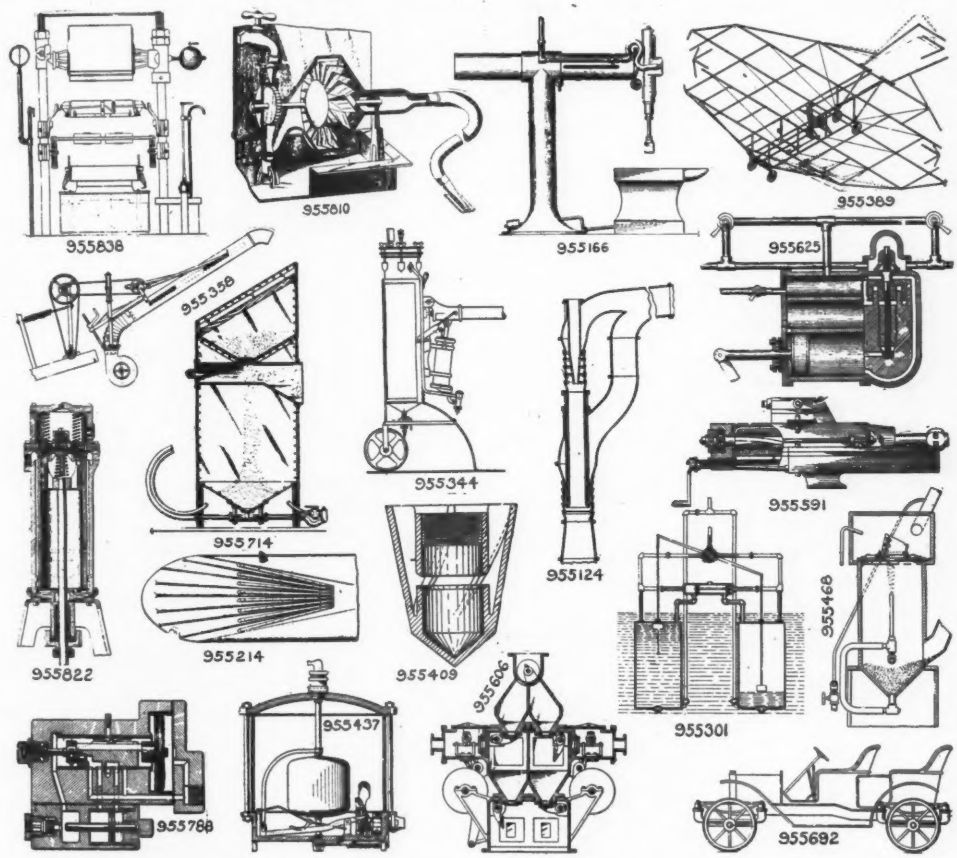
954,726. VACUUM CLEANING APPARATUS. HENRY E. FANSHAWE, New York, N. Y.

954,733. FLYING-MACHINE, ETC. ANNA O. HAGSTEDT, New York, N. Y.




PNEUMATIC PATENTS, APRIL 12.

954,938. PNEUMATIC DUST-COLLECTOR. FRED C. DE VALLANT, Earlville, N. Y.
954,944. MECHANISM FOR FEEDING PULVERIZED COAL. WILLIAM R. DUNN, Easton, Pa.
955,001. APPARATUS FOR MOISTENING YARNS. PAUL SCHILDE, Hersfeld, Germany.
955,049. AIR-SHIP. GUSTAVE H. BREKKE, Seattle, Wash.
955,064. BLOWPIPE FOR WELDING METAL. PATRICK J. GRIFFIN, Camden, N. J.
955,118. VACUUM CLEANING APPARATUS. HENRY E. FANSHAWE, New York, N. Y.
955,296. COMPRESSED-AIR MOTOR FOR PUMPS. DAVID R. TRIPPLEHORN, Findlay, O.
955,301. WATER-ELEVATOR. JAMES L. WRAY, Kewanee, Ill.
955,305. WIND-MOTOR. ALBERT W. BAILEY, Stewardson, Ill.
955,321. AIR-PUMP. DAVID F. CORNELL, Rochester, Minn.
955,344. PAINTING-MACHINE. HANS MIKOREY, Schoneberg, near Berlin, Germany.
955,358. PNEUMATIC STRAW STACKER AND ELEVATOR. AUGUST ROSENTHAL, West Allis, Wis.




PNEUMATIC PATENTS, AARIL 19.

APRIL 19.

955,124. HYDRAULIC AIR-COMPRESSOR. PETER BERNSTEIN, Mulheim-on-the-Rhine, Germany.
955,166. PNEUMATIC-HAMMER SUPPORT. HENRY M. JACOBS, Eureka, Utah.
955,214. PROPULSION OF VESSELS. FREDERICK W. SCHROEDER, London, England.

1. Apparatus for propelling deep draft vessels consisting of a vessel having a series of grooves extending aft on the inclination of the stern, a longitudinally arranged tube in each groove, said tubes having openings therein directed oppositely to the direction of propulsion, said grooves comprising air chambers increasing in cross sectional area as they extend aft, and means for propelling the vessel by forcing air or gas through said tubes, substantially as described.

955,363. AIR SANDING DEVICE. JAMES E. SCOBEE, Salt Lake City, Utah.
955,389. AEROPLANE. LAGAR R. CULVER, Salt Lake City, Utah.
955,409. AIR-DISTRIBUTING NOZZLE FOR AIR-LIFTS. GEORGE L. JOSS, Monmouth, Ill.
955,437. AUTOMATIC AIR-COMPRESSOR. JOHN ROGERS, Bridgeport, Conn.
955,468. SAND-BLAST MACHINE. CHARLES F. MOTZ, Moon township, Beaver county, Pa.
955,591. ROCK-DRILL. JAMES S. HARLOW, Mineral, Va.
955,606. APPARATUS FOR FEEDING OR DISCHARGING GRAIN, ETC. EUGENE MOREAU, New York, N. Y.

3. In an apparatus for feeding or discharging material to or from a vacuum tank, the combination of a receiving chamber having an exhaust passage, an inlet valve which controls the inlet

of said chamber, and an outlet valve which controls the outlet of said chamber, one of which valves is exposed to the atmosphere while the other valve is exposed to the vacuum, an exhaust valve which controls said exhaust passage, and mechanism for opening and closing each of said valves periodically, and operating to open said exhaust passage when said inlet and outlet valves are closed, substantially as set forth.

955,625. AIR-BRAKE SYSTEM. ANDREW J. WISNER, Philadelphia, Pa.

955,686. PNEUMATIC HAMMER. EDMOND W. RAIKES, Cleveland, Ohio.

955,692. PNEUMATIC SPRING SUSPENSION FOR VEHICLES. GEORGE A. RHOADS, Uhrichsville, Ohio.

955,714. SAND-BLAST APPARATUS. GEORGE F. STEEDMAN, St. Louis, Mo.

955,788. AIR-BRAKE. CHARLES W. FRYE, Atlanta, Ga.

955,810. VACUUM CLEANING APPARATUS. ALBERT F. KRAUSE, Buffalo, N. Y.

955,818. OZONIZER. ANTHONY LOHMAN, Philadelphia, Pa.

955,822. COMPRESSOR. JOHN D. MAYHEW, Tyler, Tex.

955,838. MOLDING-MACHINE. JOHN ALLENSON, St. Paul, Minn.

RATUS. WILHELM MAUSS, Johannesburg, Transvaal.

3. In combination, a fluid actuated percussive engine including a reciprocating percussive member and in which the quantity of fluid admitted to the front cylinder space varies with the extent of the forward stroke of the percussive member, means adapted automatically to effect controlled forward movement of the engine, said last named means being governed by the percussive member and operating to produce forward movement of the engine upon the rearward stroke of the percussive member exceeding a prescribed limit.

956,026. SPRAYING DEVICE FOR ROCK-DRILLS. WILLIAM J. BARNETT, Germiston, Transvaal.

956,044. ROCK-DRILL. HENRY A. DALMAS, Manassas, Va.

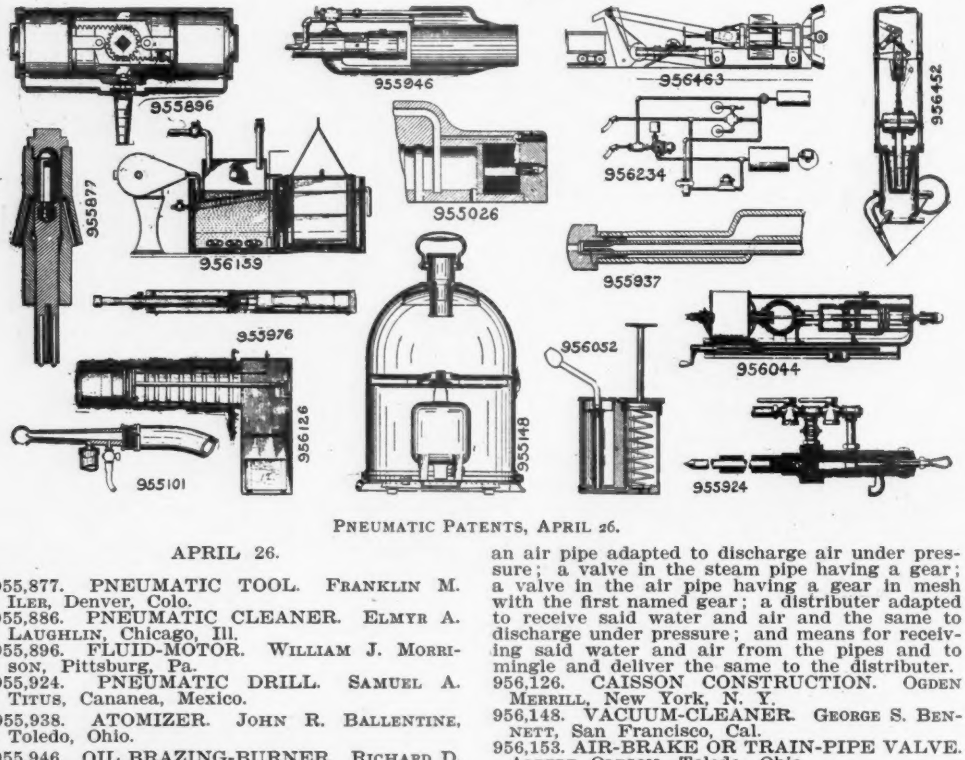
956,052. POCKET-ATOMIZER. FRANK C. DORMENT, Detroit, Mich.

956,100. VACUUM-CLEANER. ROBERT B. HUTCHINSON, Wilkinsburg, Pa.

956,101. SPRAYING APPARATUS. WILLIAM B. INGLIS, Pawtucket, R. I.

956,103. HUMIDIFIER. JAMES KELLY, Providence, R. I.

3. In a humidifier, the combination of a water pipe adapted to discharge water under pressure;




PNEUMATIC PATENTS, APRIL 26.

## APRIL 26.

955,877. PNEUMATIC TOOL. FRANKLIN M. ILER, Denver, Colo.

955,886. PNEUMATIC CLEANER. ELMYR A. LAUGHLIN, Chicago, Ill.

955,896. FLUID-MOTOR. WILLIAM J. MORRISON, Pittsburg, Pa.

955,924. PNEUMATIC DRILL. SAMUEL A. TITUS, Cananea, Mexico.

955,938. ATOMIZER. JOHN R. BALLENTINE, Toledo, Ohio.

955,946. OIL BRAZING-BURNER. RICHARD D. CONRAD, Pittsburg, Pa.

1. In an oil brazing burner, a vaporizer having a bore therethrough, an air-blast tube in alinement with said bore, an oil-supply pipe leading to said vaporizer, a conduit connecting the vaporizer with the air-blast tube, and a mixer in said tube in advance of the point of discharge of the volatilized fuel thereinto, the discharge end of the tube and the inlet end of the bore being relatively positioned to effect combustion within the bore.

955,976. AUTOMATIC PERCUSSIVE APPA-

an air pipe adapted to discharge air under pressure; a valve in the steam pipe having a gear; a valve in the air pipe having a gear in mesh with the first named gear; a distributer adapted to receive said water and air and the same to discharge under pressure; and means for receiving said water and air from the pipes and to mingle and deliver the same to the distributer.

956,126. CAISSON CONSTRUCTION. OGDEN MERRILL, New York, N. Y.

956,148. VACUUM-CLEANER. GEORGE S. BENNETT, San Francisco, Cal.

956,153. AIR-BRAKE OR TRAIN-PIPE VALVE. ALBERT OLESON, Toledo, Ohio.

956,159. AIR PURIFYING AND DISTRIBUTING APPARATUS. WILLIAM B. PATRICK, Woodland, Cal.

956,234. COMBINED AUTOMATIC AND STRAIGHT AIR-BRAKE. WALTER V. TURNER, Edgewood, Pa.

956,287. CUT-OFF FOR FLUID-PRESSURE MOTORS. JOSEPH H. CHAMP, Cleveland, Ohio.

956,452. HAND VACUUM-CLEANER. JOHN S. THURMAN, St. Louis, Mo.

956,463. TUNNELING-MACHINE. WILLIAM F. WITTICH, Erie, Pa.

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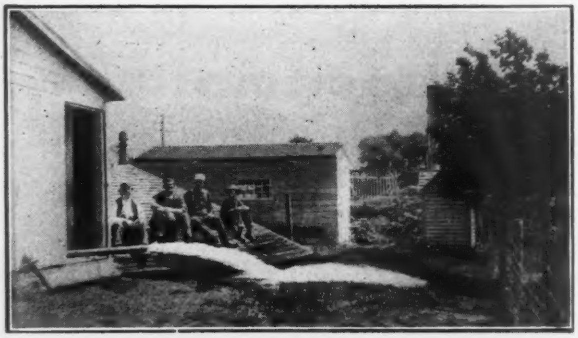

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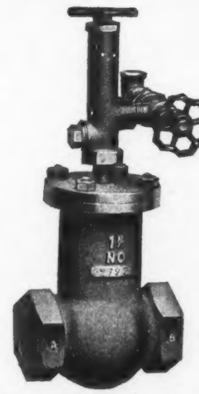

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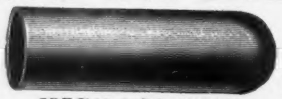

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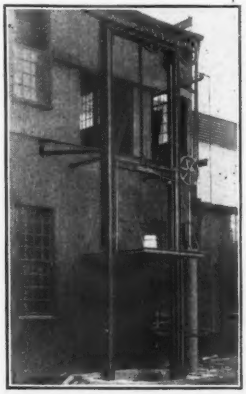

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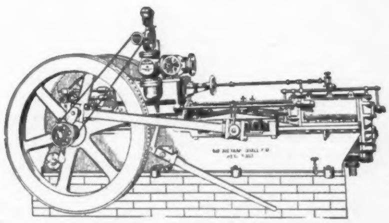

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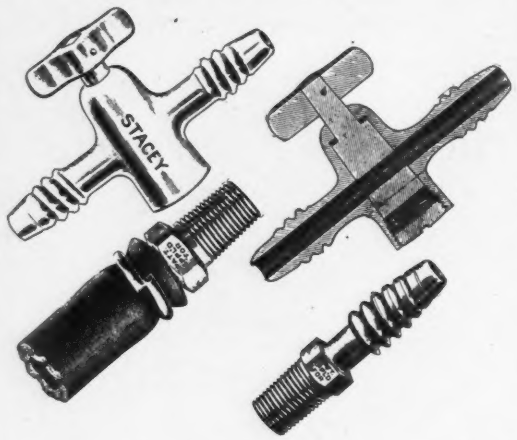


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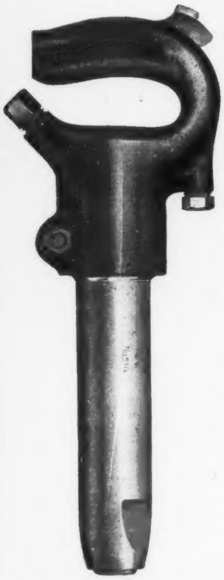

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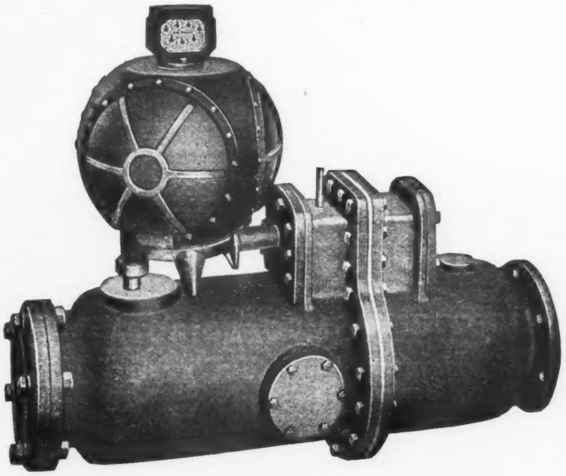

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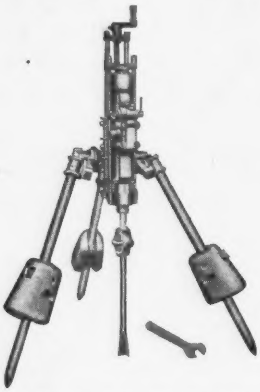

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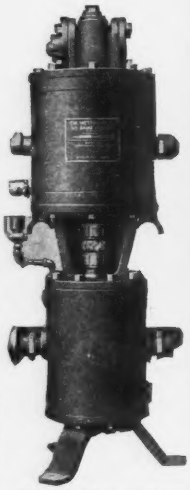

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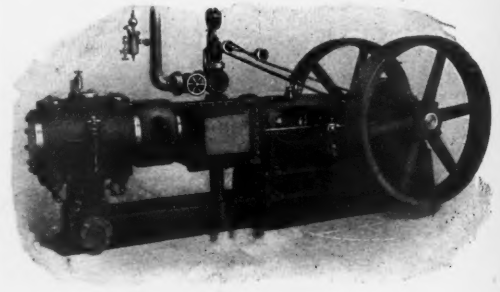

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